



INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification ⁶ : E04C 2/04, B28B 19/00	A1	(11) International Publication Number: WO 99/14449 (43) International Publication Date: 25 March 1999 (25.03.99)
(21) International Application Number: PCT/CA98/00851 (22) International Filing Date: 9 September 1998 (09.09.98) (30) Priority Data: 2,211,984 12 September 1997 (12.09.97) CA (71) Applicant: UNIFIX INC. [CA/CA]; 35 Rue Unifix, Bromont, Quebec J2L 1N5 (CA). (72) Inventor: MATHIEU, Marc-André; 400-A Chemin Mont-Shefford, Waterloo, Quebec J0E 2N0 (CA). (74) Agent: KOSIE, Ronald, S.; Brouillette Kosie, Suite 25, 1100 René-Lévesque Ouest, Montreal, Quebec H3B 5C9 (CA).	(81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GE, GH, GM, HR, HU, ID, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, UZ, VN, YU, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG). Published With international search report.	
(54) Title: CEMENTITIOUS PANEL WITH REINFORCED EDGES (57) Abstract <p>A cementitious panel comprising a cementitious core (10) which is fabric-reinforced at the surface thereof (3, 12) and whose longitudinal edges are reinforced by a network of fibers. A panel may be obtained wherein the surface edge reinforcement layers are relatively strong and hard such that a nail or screw may be driven through the edge of panel without pre-drilling and without breaking, even when nailed or screwed almost at the very limit of the edge of the panel. Such a panel may provide a long lasting substrate for humid or wet areas such as shower rooms and bathrooms.</p> <div data-bbox="711 953 1224 1499"> </div> <div data-bbox="1325 1205 1451 1352"> <p>180 56 236</p> </div>		



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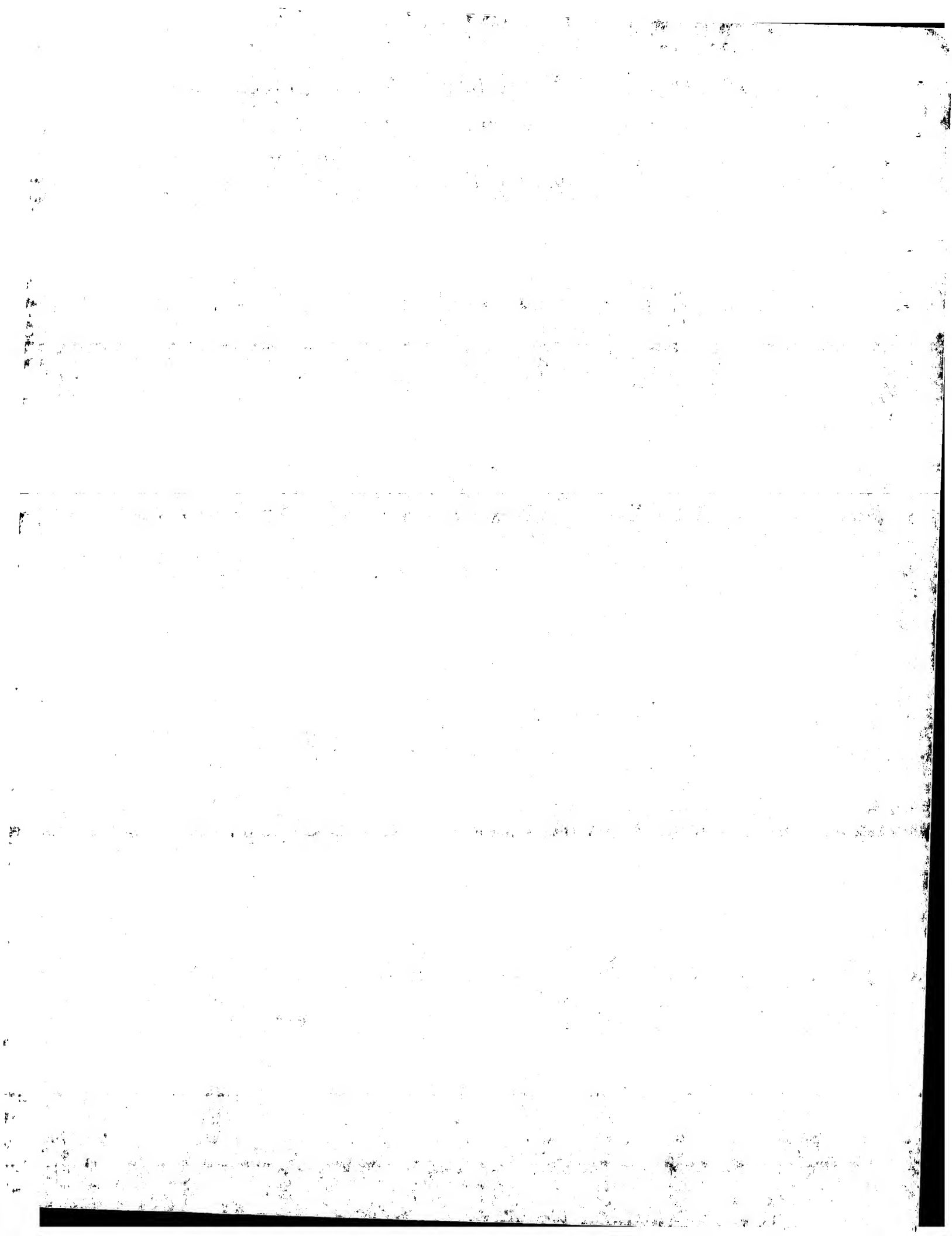
TITLE: CEMENTITIOUS PANEL WITH REINFORCED EDGES

The present invention relates to reinforced cementitious panels or boards comprising a cementitious core, the boards or panels being fabric-reinforced at the surface thereof. More particularly, it relates to panels or boards whose opposed broad faces are reinforced by a network of fibers which may be adhered at a surface thereof e.g. be adhered to or embedded at or just below the cementitious surfaces thereof. Still more particularly, the present invention relates to a cementitious board whose longitudinal edges are reinforced by a network of fibers. Such a cementitious panel or board may, for example, be a light-weight concrete panel, a tile backerboard panel, or the like.

15

The word "cementitious" as used herein is to be understood as referring to any material, substance or composition containing or derived from a hydraulic cement such as for example, portland cement (see below). The term "slurry" is to be understood as referring to a flowable mixture, e.g. a flowable mixture of water and a hydraulic cement. The term "core mix" is to be understood as referring to a mixture of a hydraulic

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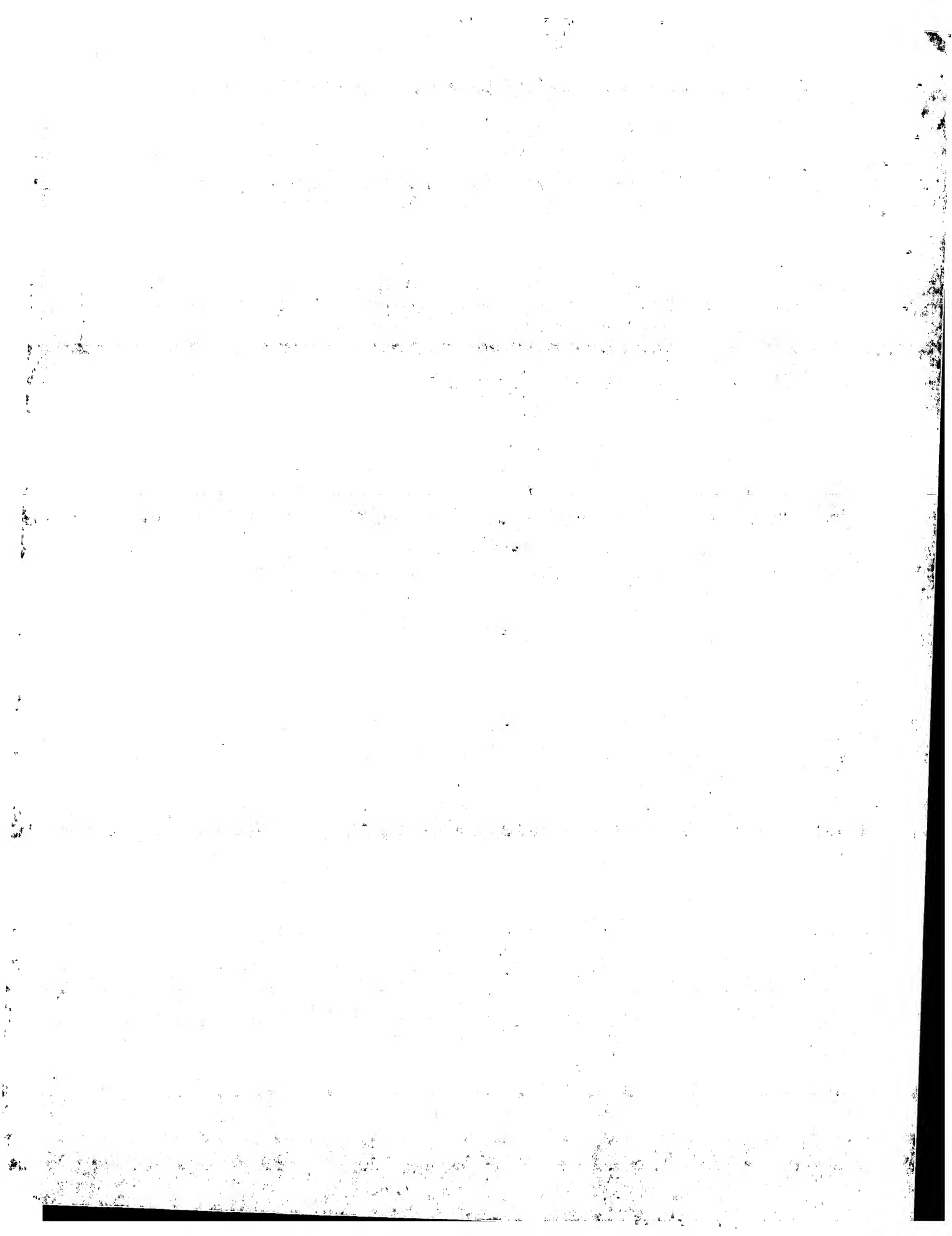
cement, water and aggregate (such as sand, expanded shale or clay, expanded polystyrene beads, slag and similar materials - see below), as well as, if desired or necessary, additional additives such as foaming agents, modifiers and the like.

5 The term "slurry pervious reinforcing mesh" is to be understood as characterizing a mesh as being suitable for use in the preparation of a concrete panel by having openings sufficiently large to permit penetration of a cementitious slurry or a slurry component of a core mix into and through
10 the openings so as to permit (mechanical) bonding of the mesh to the core either by for example by being cemented to the core or by being embedded in a face or surface of the core of a panel.

15 The expression "slurry impervious mesh" is to be understood as characterizing a mesh as being water impervious or as being able to filter out or inhibit the penetration of slurry solids therein so as to inhibit (mechanical) bonding of the mesh to the core by the cementitious material.

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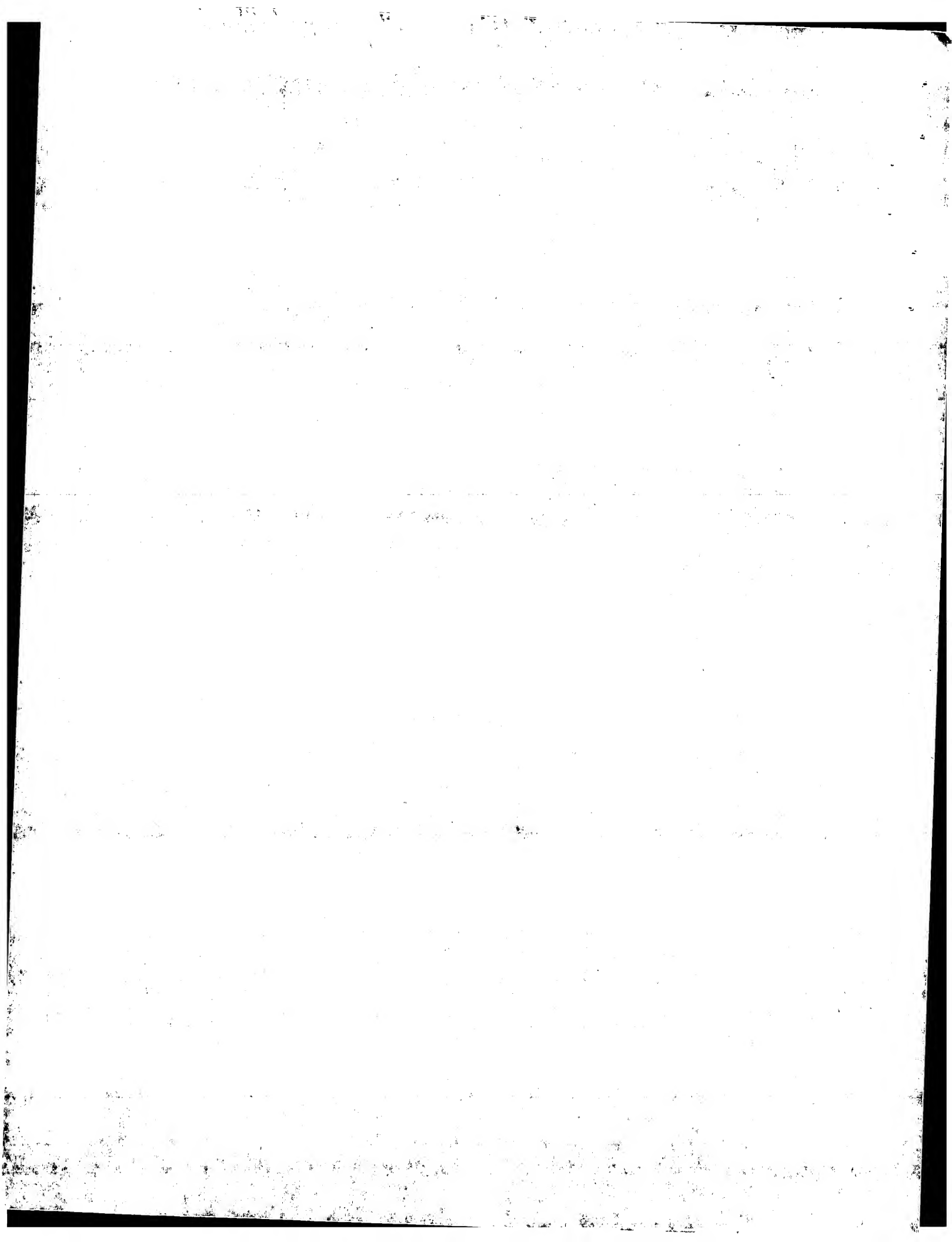
It is to be understood herein that the expression "adhered to" in relation to a reinforcing mesh component (e.g. mesh, mat,



fabric, tissue, etc.) means that the mesh component may be adhered for example to a face or surface by any suitable means such as by an adhesive, by a cement, or by being embedded in, at or immediately beneath the surface of a respective face or surface such that the mesh component is effectively bonded to the core, i.e. a hardened or set cementitious material extends through the interstices of the fibrous layers.

Keeping the above immediate definition in mind, it is to be understood herein that the expression "adhered to said core at" in relation to a reinforcing mesh component (e.g. mesh, mat, fabric, tissue, etc.) means that the mesh component does not extend beyond the specified face, area, region, or the like, i.e. it is restricted to the specified face region etc.. Thus for example in relation to a broad face reinforcing mesh indicated as being adhered to a core at a broad face means that the mesh is restricted to being adhered to the broad face.

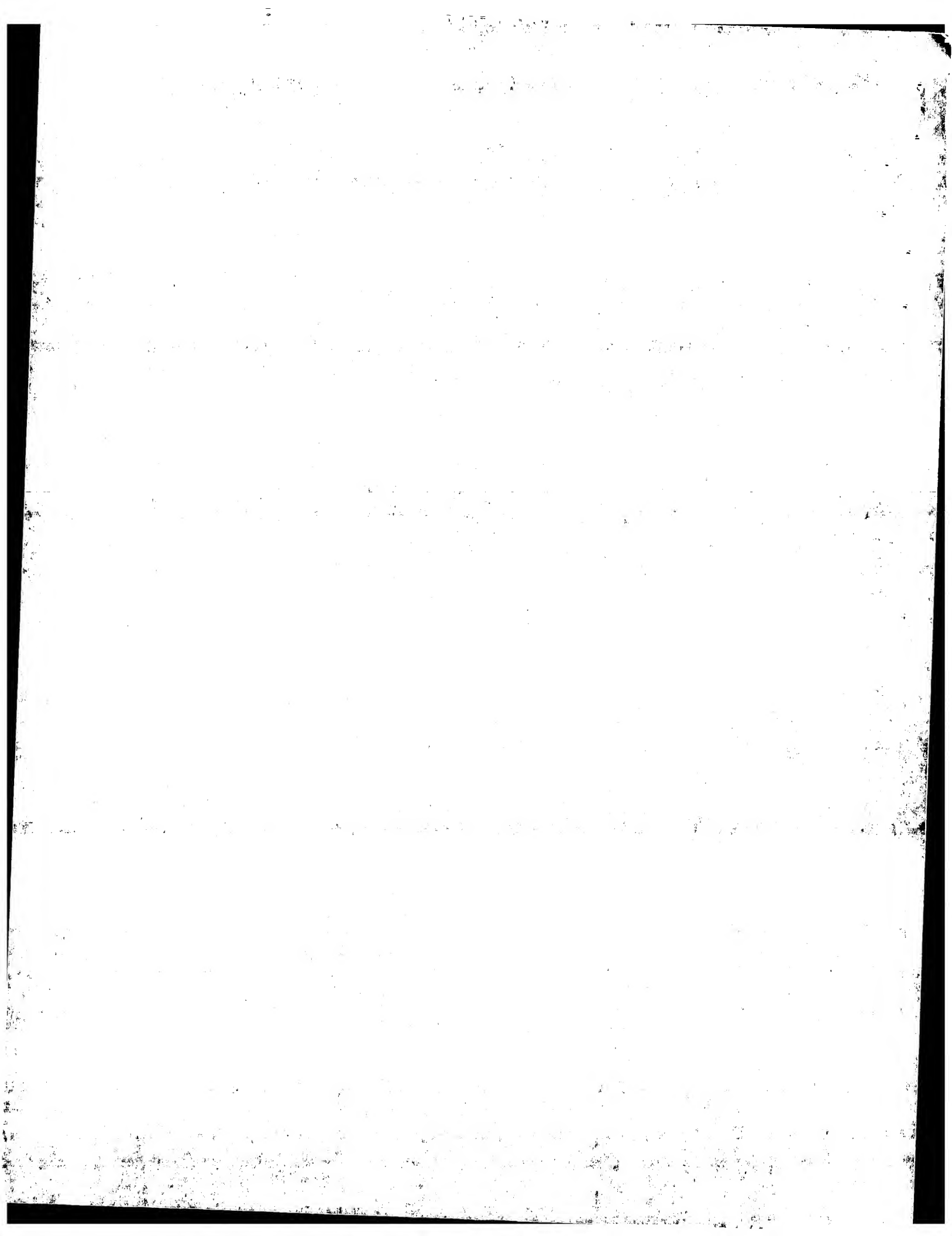
The word "woven" as used herein is to be understood as characterizing a material such as a reinforcing mesh (e.g. mat, fabric, tissue or the like) as comprising fibers or filaments which are oriented; oriented fibers or filaments



being disposed in an organized fashion.

The word "non-woven" as used herein is to be understood as characterizing a material such as a reinforcing mesh (e.g. mat, fabric, tissue or the like) as comprising fibers or
5 filaments which are oriented (as described above) or which are non-oriented; non-oriented fibers or filaments being disposed in random fashion.

In general, a reinforced cementitious panel or board may be
10 fastened to a wall frame for the construction of a wall and particularly for the construction of a wall where high moisture conditions are to be encountered. Such a wall panel may provide a long lasting substrate for humid or wet areas such as shower rooms and bath rooms and provide high impact
15 resistance where there is high number of people circulating. For example, such a reinforced cementitious panel or board may be used as a substrate for ceramic tile in bath rooms, shower rooms, locker rooms, swimming pool rooms and other areas where the wall are subject to frequent splashing of water and
20 high humidity. Once the panel is affixed to a wall frame a wall facing material may, as desired or necessary, in turn be affixed thereto such as, for example, ceramic tile, thin



brick, thin marble panels, stucco or the like.

Reinforced cementitious panels or boards having cores formed of a cementitious composition with the faces being reinforced with a layer of fabric bonded thereto are known; see for example US patent nos. 1,439,954, U.S. Patent No. 3,284,980, 5 U.S. Patent No. 4,450,022, U.S. Pat. No. 4,916,604, etc..

Various processes for the preparation of such cementitious boards or panels are also known. British Patent application no. 2,053,779 for example discloses a method for the 10 continuous production of a building board which comprises advancing a pervious fabric on a lower support surface, depositing a slurry of cementitious material onto the advancing fabric, contacting the exposed face of the slurry with a second fabric such that the slurry penetrates through 15 the fabric to form a thin, continuous film on the outer faces of the fabric.

Because of its cementitious nature, a cement board may have a tendency to be relatively brittle.

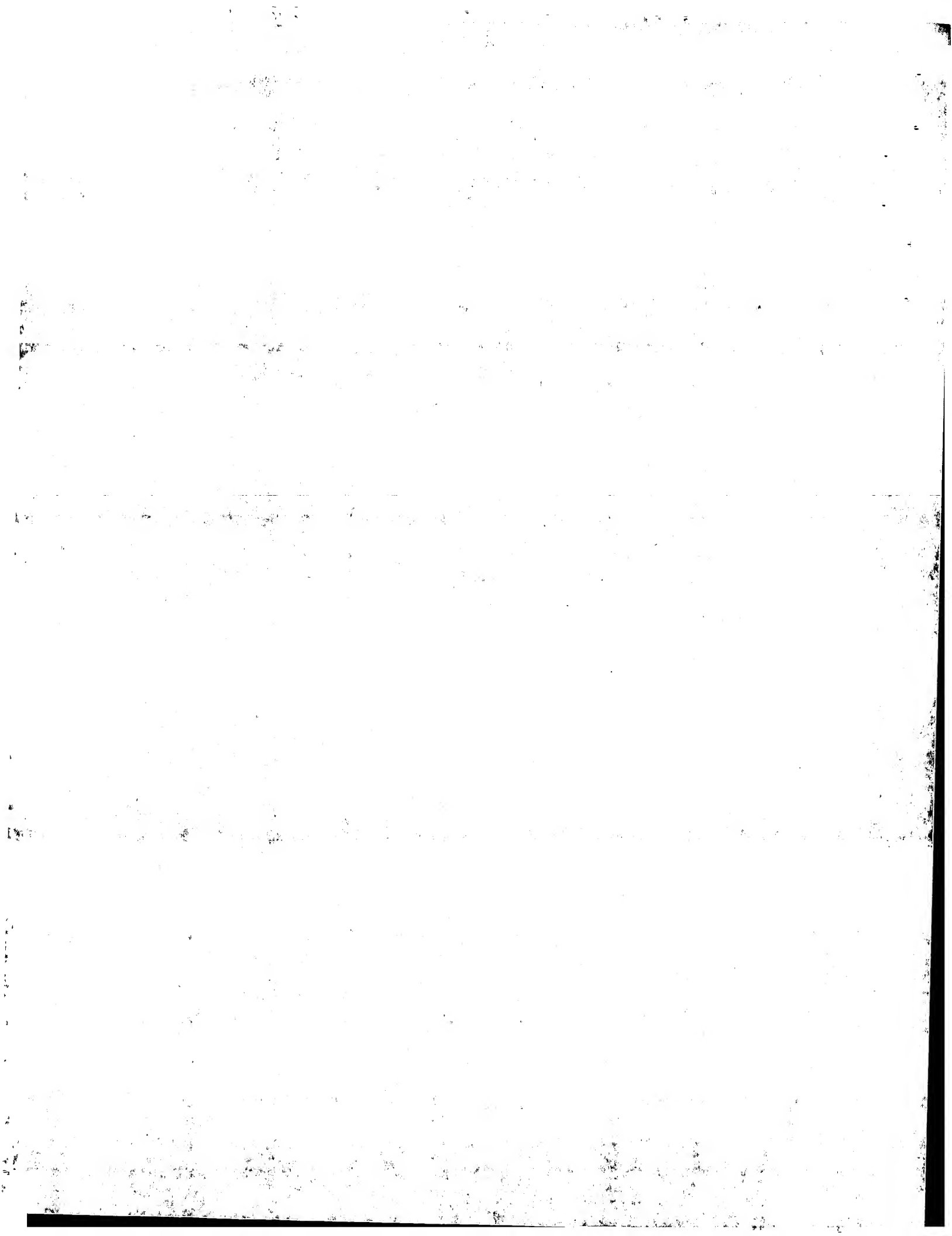
20 Cementitious wall board or panels are often attached at their marginal edges to the building framework with for example

fasteners such as nails, screws and the like. When fasteners for example such as screws or nails are installed near the edge (less than $\frac{1}{2}$ "), it is highly desirable that the edge be able to retain sufficient structural integrity such that the panel remains attached to a wall member, i.e. that the panel have a relatively high fastener pull resistance such that the fastener will not laterally pull through or break through the board edge.

It is known to augment the strength of the border edge regions by wrapping the fabric covering one broad face of the board around the edge so as to overlay the fabric on the other opposite broad side thereof.

US patent no. 4,916,004, for example, discloses a cement board having a woven mesh of glass fibers immediately below each face thereof, the mesh in one broad face continuing under the surface of both longitudinal edge faces, with the two meshes in an abutting or an overlapping relation along the longitudinal margins of the opposite face. Please also see U.S. patent nos. 5,221,386 and 5,350,554.

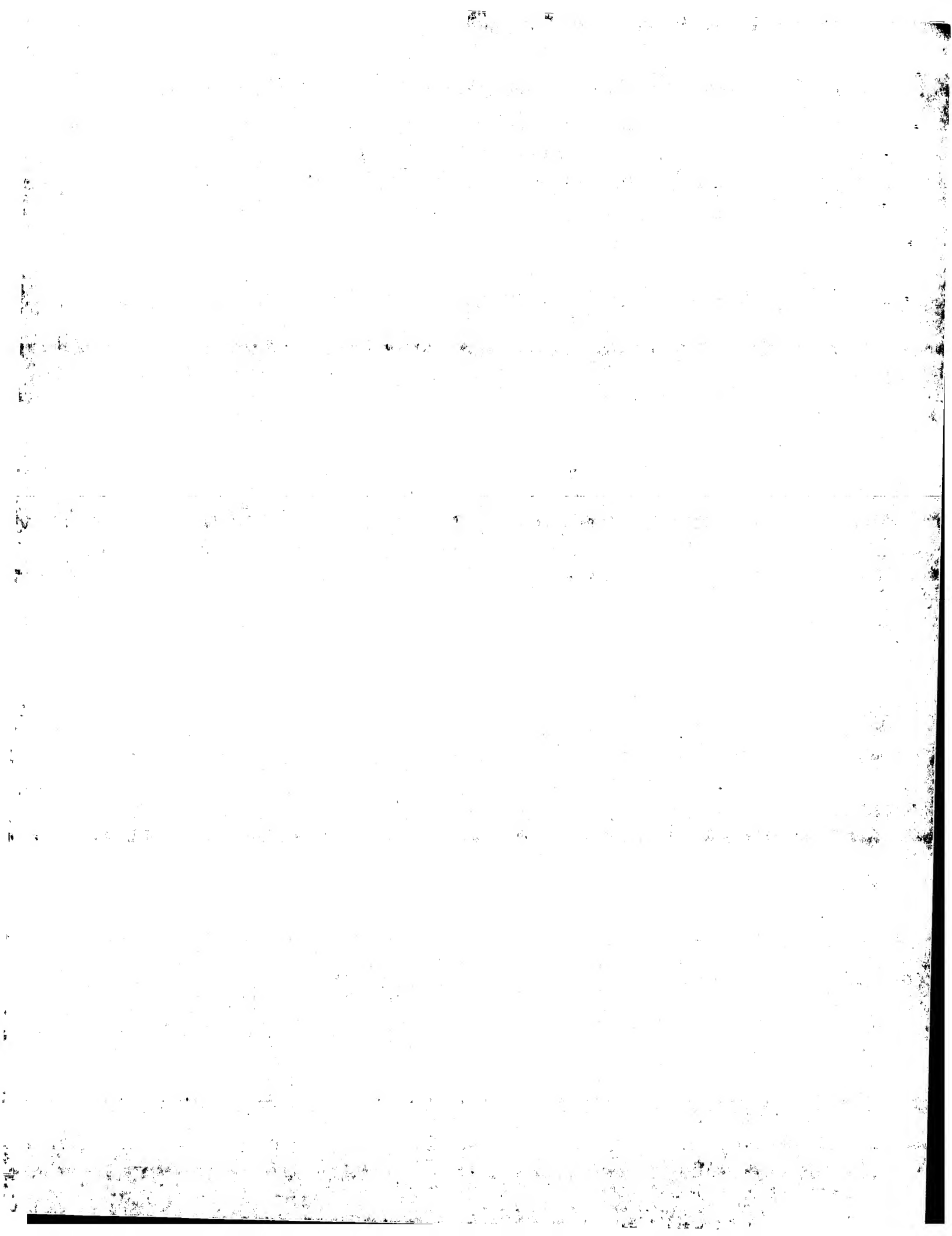
US patent no. 4,504,533, for example, discloses a gypsum board



in which a composite web of a non-woven fiberglass felt and a woven fiberglass mat covers the upper and lower faces of a gypsum core while only the lower non-woven fiberglass felt is wrapped around the longitudinal edges of the gypsum core so that the non-woven fiberglass felt extends partially inward on the upper face of the core such that the border edge regions are covered only by non-woven fiberglass felt.

U.S. patent no. 1,787,163 on the other hand discloses a gypsum board in which side edge portions include a separate strip of U-shaped fabric extending from one broad face across the edge to the other broad face; the fabric legs of this separate strip each extend into the plaster core body beneath a respective sheet of fibrous material covering a respective broad face, i.e. the legs are submerged below the broad face and in particular below the broad face reinforcement means.

The problem common to all methods of production of fiber mesh reinforced cementitious panels still remains as to how to effectively reinforce longitudinal edges of cementitious panels. The problem is particularly difficult when the economics of continuous production are desired. Glass fiber mesh, is a common reinforcing fabric and is used in the form



of a fibreglass scrim. The open fibreglass scrim may be relatively easily damaged and commonly has openings sized such that the core material can pass through when sufficient force is applied, thus reducing the integrity of the board. Therefore, its edges may be particularly fragile such that
5 special care is needed when manipulating or installing such a cementitious board or panel.

It would be advantageous to be able to have an alternate manner of making an alternative type panel configured such
10 that when a nail, screw or like shaft fastener is inserted close to the edge of a panel the mesh reinforced edge may minimize edge break out by the nail or screw or like shaft fastener of edge and thus provide secure attachment of the panel to a framing support.

15 It would for example be advantageous to be able to customize the reinforcement characteristics of the longitudinal edge area of a panel by being able to choose a desired reinforcement mesh component which is different from the mesh
20 used for the broad faces of a wall panel core and being able to choose a desired attachment technique to the longitudinal edge. It would be advantageous for example too be able to

have a panel or board wherein the edge reinforcing mesh may be different from the broad face reinforcing mesh (e.g. of a different substance, of different mesh openings, of non-oriented fibers or filaments rather than oriented fibers or filaments).

5

It would be advantageous to be able to have a panel wherein the longitudinal edge face of the panel may be more or less free of cementitious material so as to allow the longitudinal edge face to be used as a support substrate for a visual indicia such as colour, images, symbols, words, etc., i.e. such that an indicia would not be covered up during the manufacturing process by cementitious material.

10

It would be advantageous to be able to have a means of treating the side edges of the board in the course of manufacture in such a manner as to enhance its structural qualities and its use for the purposes intended. It in particular would be advantageous to be able to have a means of manufacturing the edges of the board in such a manner that it will have impact resistant edges and be able to be constructed so as to be able to offer a relatively higher lateral fastener pull resistance in the edge area than in the central core

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area.

STATEMENT OF INVENTION

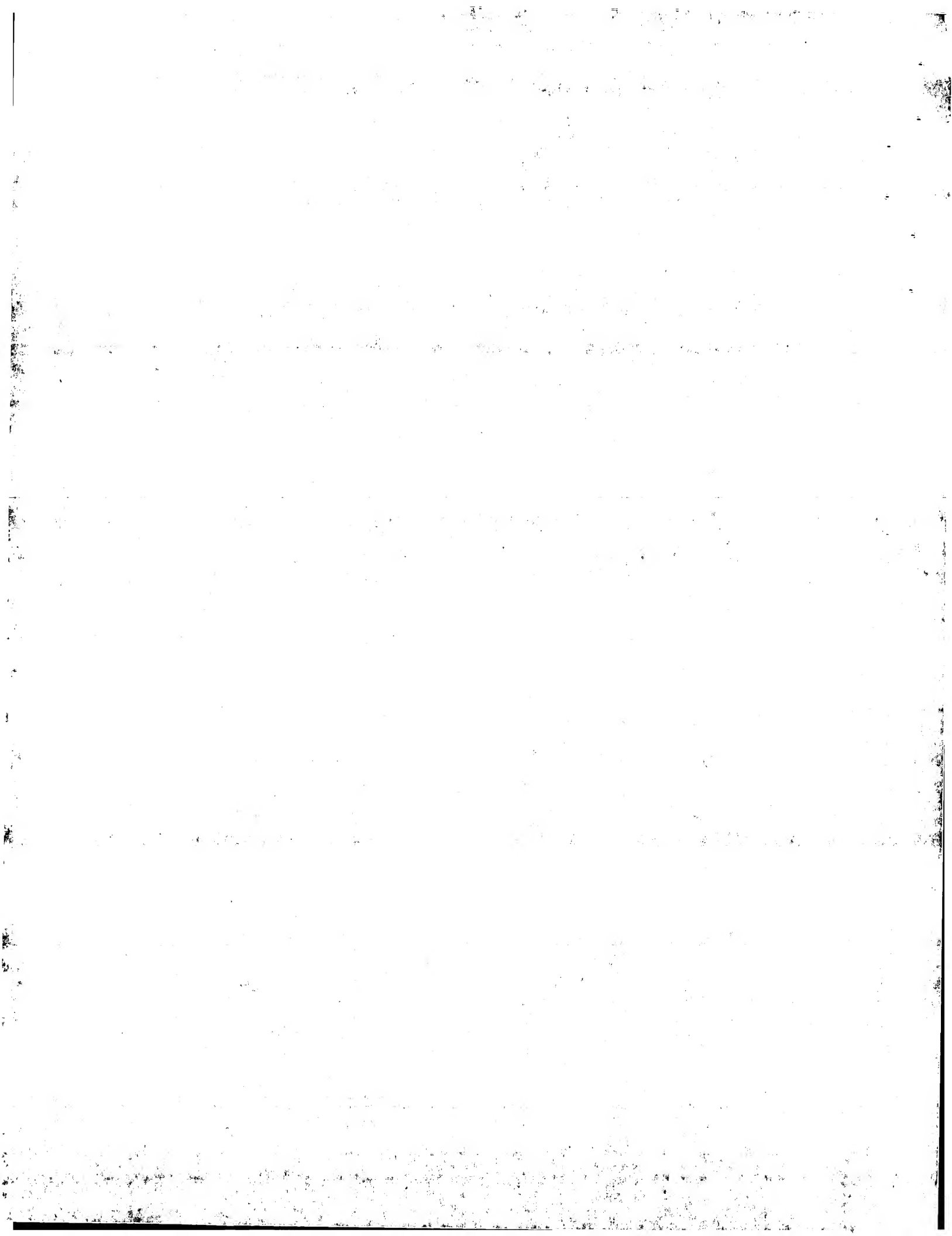
5 The present invention in an aspect provides a cementitious panel comprising a longitudinal side edge face, a pair of opposed broad faces, a longitudinal marginal edge, a light weight cementitious core, a first broad face reinforcing mesh component, a second broad face reinforcing mesh component, and
10 a first edge reinforcing mesh component,

each broad face comprising a marginal area bordering said longitudinal edge face

said longitudinal marginal edge comprising a marginal area of one of said broad faces, an opposed marginal area of
15 the other of said broad faces and said longitudinal side edge face,

said first and second broad face reinforcing mesh components each being adhered to said core at a respective broad face,

20 said first edge reinforcing mesh component comprising an edge strip member being adhered to said core at a marginal area of said longitudinal marginal edge,



said first and second broad face reinforcing meshes and said first edge reinforcing mesh being configured and disposed such that said strip member overlaps one of said first and second reinforcing meshes in a respective marginal area of said longitudinal marginal edge.

5

In accordance with the present invention the reinforcing mesh overlapped by said strip member may be is offset inwardly relative to the longitudinal side edge face of said longitudinal marginal edge.

10

In accordance with another aspect the present invention provides a cementitious panel comprising a longitudinal side edge face, a pair of opposed broad faces, a longitudinal marginal edge, a light weight cementitious core, a first broad face reinforcing mesh component, a second broad face reinforcing mesh component, and a first edge reinforcing mesh component,

15

each broad face comprising a marginal area bordering said longitudinal edge face

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said longitudinal marginal edge comprising a marginal area of one of said broad faces, an opposed marginal area of the other of said broad faces and said longitudinal side edge

face,

said first and second broad face reinforcing mesh components each being adhered to said core at a respective broad face,

5 said first edge reinforcing mesh component comprising first and second edge strip members being adhered to said core at respective opposed marginal areas of said longitudinal marginal edge,

10 said first and second broad face reinforcing meshes and said first edge reinforcing mesh being configured and disposed such that said first and second strip members respectively overlap the first and second reinforcing meshes in the marginal areas of said longitudinal marginal edge.

15 In accordance with the present invention the first and second broad face reinforcing meshes may be offset inwardly relative to the longitudinal side edge face of said longitudinal marginal edge.

20 In accordance with the present invention there is provided a cementitious panel comprising a longitudinal side edge face, a pair of opposed broad faces, a longitudinal marginal edge, a light weight cementitious core, a first broad face reinforcing

mesh component, a second broad face reinforcing mesh component, and a first U-shaped edge reinforcing mesh component,

each broad face comprising a marginal area bordering said longitudinal edge face

5 said longitudinal marginal edge comprising a marginal area of one of said broad faces, an opposed marginal area of the other of said broad faces and said longitudinal side edge face,

 said first and second broad face reinforcing mesh
10 components each being adhered to said core at a respective broad face,

 said first U-shaped edge reinforcing mesh component comprising first and second edge strip members and a bridging member connecting said first and second edge strip members,
15 said first and second edge strip members being adhered to said core at respective opposed marginal areas of said longitudinal marginal edge,

 said first and second broad face reinforcing meshes and said first U-shaped edge reinforcing mesh being configured and
20 disposed such that said first and second strip members respectively overlap the first and second reinforcing meshes in the marginal areas of said longitudinal marginal edge.

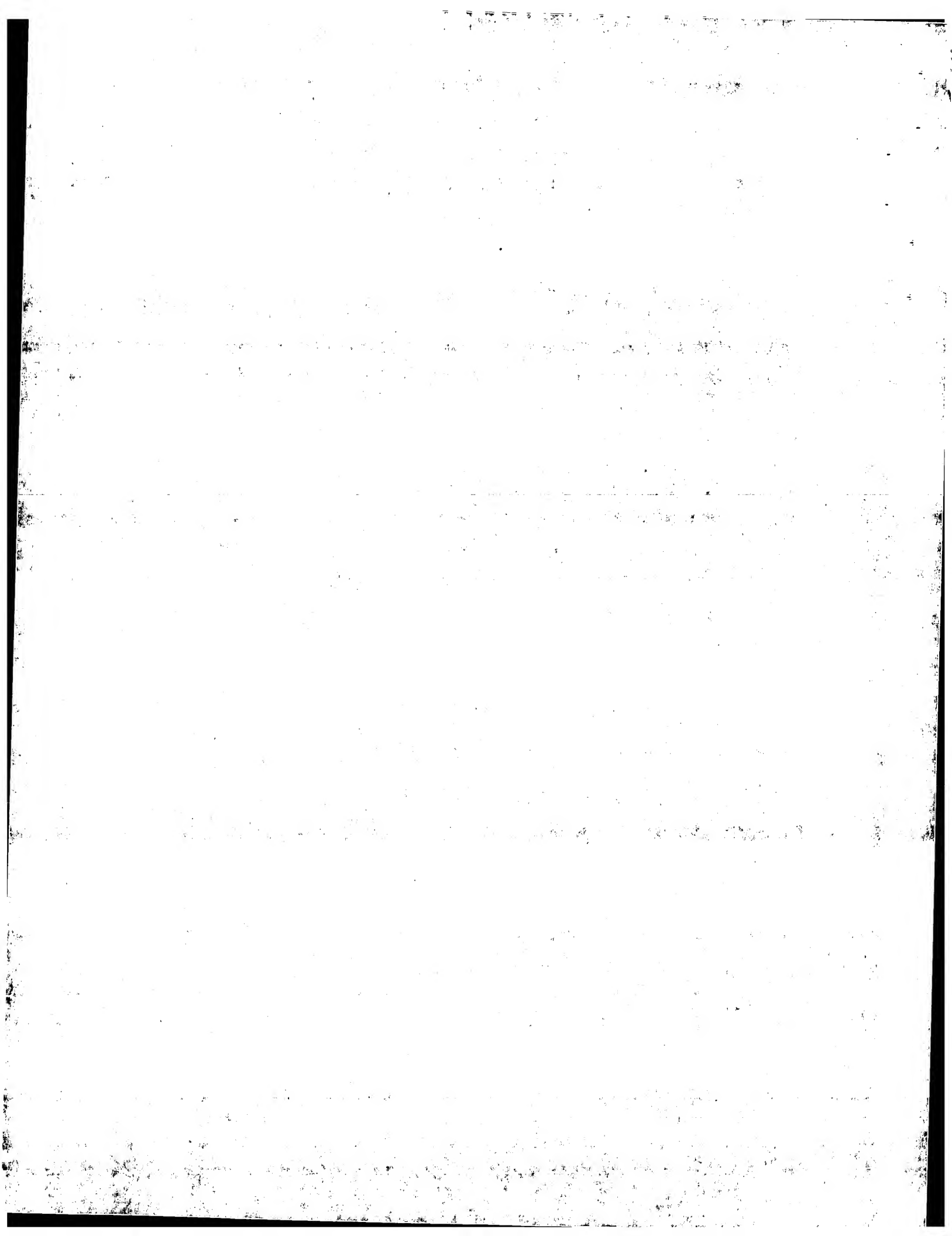
In accordance with the present invention the first and second broad face reinforcing meshes may as mentioned above be offset inwardly relative to the longitudinal side edge face of said longitudinal marginal edge.

- 5 7. A cementitious panel as defined in claim 5 wherein said bridge member is non-adhered to said core at said longitudinal side edge face.

In accordance with the present invention the first and second
10 broad face reinforcing meshes may be offset inwardly relative to the longitudinal side edge face of said longitudinal marginal edge and a bridge member may be non-adhered to said core at said longitudinal side edge face.

- 15 In accordance with the present invention marginal area(s) may comprise an adhesion region and a non-adhesion region, said non-adhesion region(s) bordering said longitudinal side edge face(s) and the first and second edge strip members may be non-adhered to said core at respective non-adhesion regions;
20 may be non-embedded; may be abutting appropriate faces, etc..

In accordance with a further aspect the present invention



provides a cementitious panel comprising a pair of opposed longitudinal side edge faces, a pair of opposed broad faces, a pair of opposed longitudinal marginal edges, a light weight cementitious core, a first broad face reinforcing mesh component, a second broad face reinforcing mesh component, a first U-shaped edge reinforcing mesh component and a second U-shaped edge reinforcing mesh component,

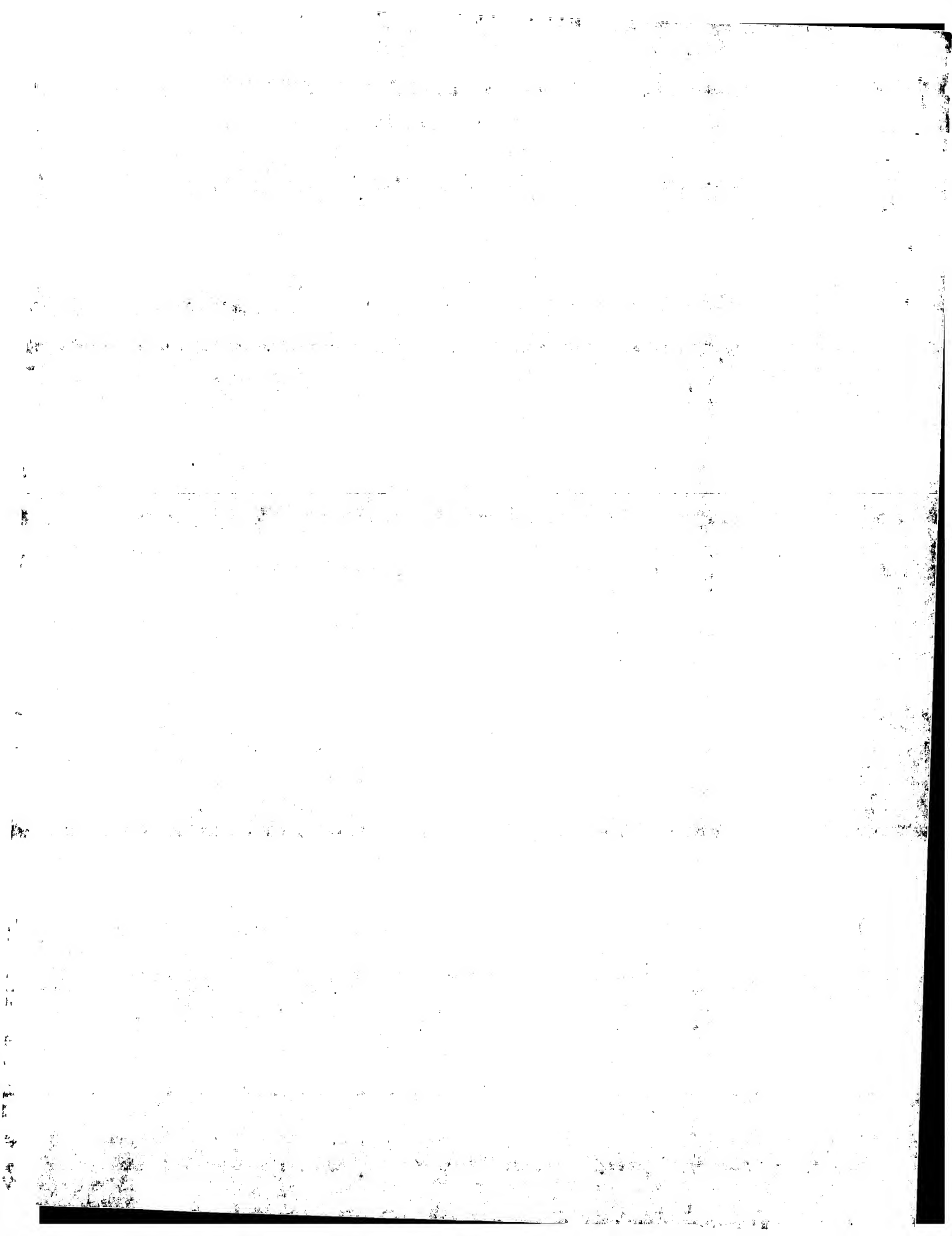
each broad face comprising a marginal area bordering each longitudinal edge face

each longitudinal marginal edge comprising a marginal area of one of said broad faces, an opposed marginal area of the other of said broad faces and a respective longitudinal side edge face,

said first and second broad face reinforcing mesh components each being adhered to said core at a respective broad face,

said first and second U-shaped edge reinforcing mesh components each comprising first and second edge strip members and a bridging member connecting said first and second edge strip members, said first and second edge strip members being adhered to said core at respective opposed marginal areas of a respective longitudinal marginal edge,

said first and second broad face reinforcing mesh



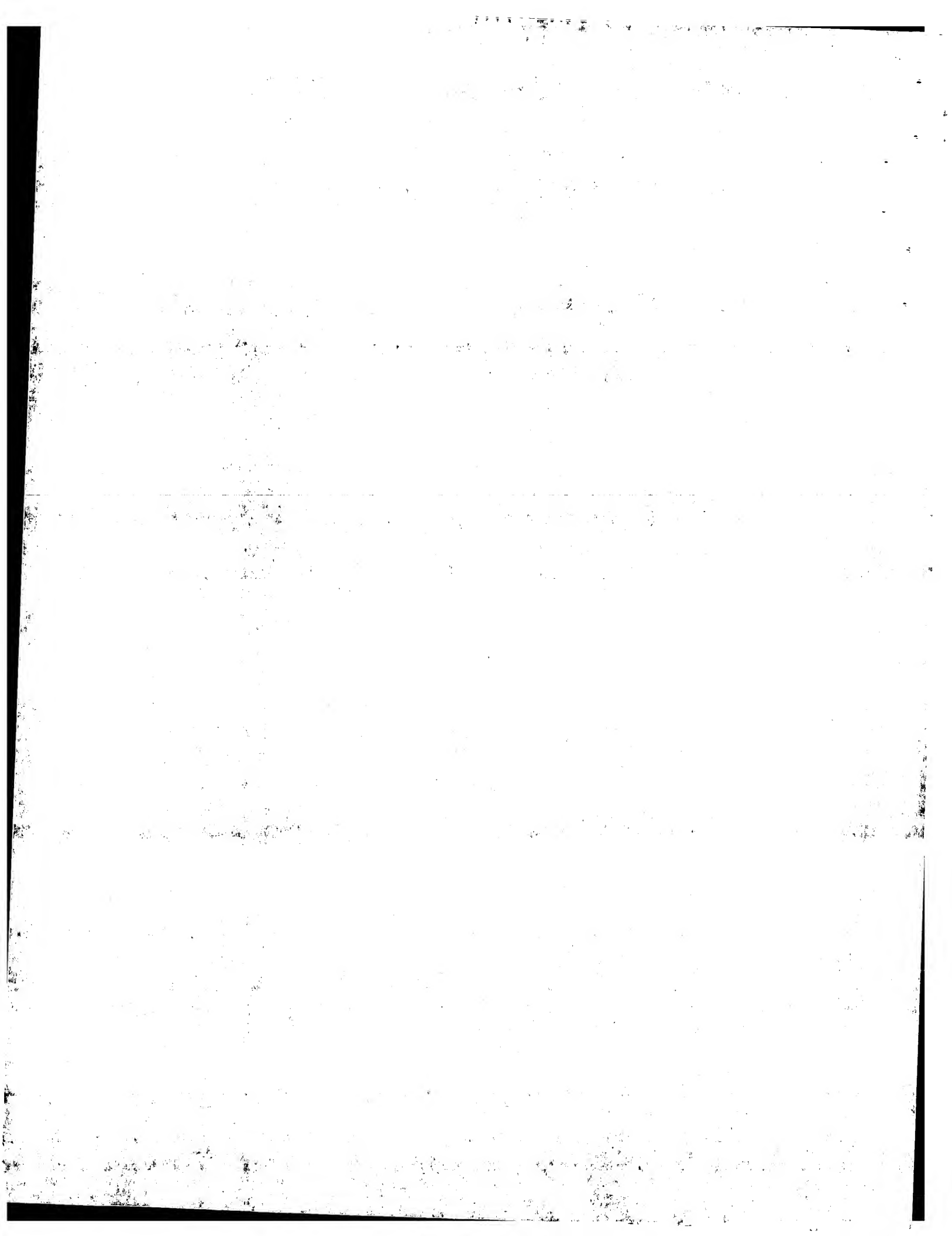
components and said first and second U-shaped edge reinforcing mesh components being configured and disposed such that said first and second strip members respectively overlap the first and second reinforcing meshes in the marginal areas of a respective longitudinal marginal edge.

In accordance with the present invention, as mentioned above, the first and second broad face reinforcing meshes may be offset inwardly relative to the longitudinal side edge faces of said longitudinal marginal edges.

In accordance with the present invention as mentioned above a bridge member(s) may be non-adhered to said core at respective longitudinal side edge face(s).

In accordance with the present invention as mentioned above the first and second broad face reinforcing meshes may be offset inwardly relative to the longitudinal side edge faces of said longitudinal marginal edges and bridge members may be non-adhered to said core at respective longitudinal side edge faces.

In accordance with the present invention as mentioned above



marginal areas may comprise an adhesion region and a non-adhesion region, said non-adhesion regions bordering said longitudinal side edge faces and first and second edge strip members may be non-adhered to said core at respective non-adhesion regions.

5

In accordance with the present invention the first and second broad face reinforcing mesh components may each be embedded in a respective broad face of said core and first and second edge strip members may be cemented to said core at respective opposed marginal areas of a respective longitudinal marginal edge.

In accordance with the present invention as mentioned first and second broad face reinforcing meshes may be offset inwardly relative to the longitudinal side edge faces of said longitudinal marginal edges and bridge members may be non-adhered to said core at respective longitudinal side edge faces.

In accordance with the present invention a bridge member(s) may be are non-adhered to said core at respective longitudinal side edge face(s).

In accordance with the present invention as mentioned first and second broad face reinforcing meshes may be offset inwardly relative to the longitudinal side edge faces of said longitudinal marginal edges, bridge members may be non-adhered to said core at respective longitudinal side edge faces.

5

In accordance with the present invention as mentioned marginal areas may comprise an adhesion region and a non-adhesion region, said non-adhesion regions bordering said longitudinal side edge faces and first and second edge strip members may be non-adhered to said core at respective non-adhesion region.

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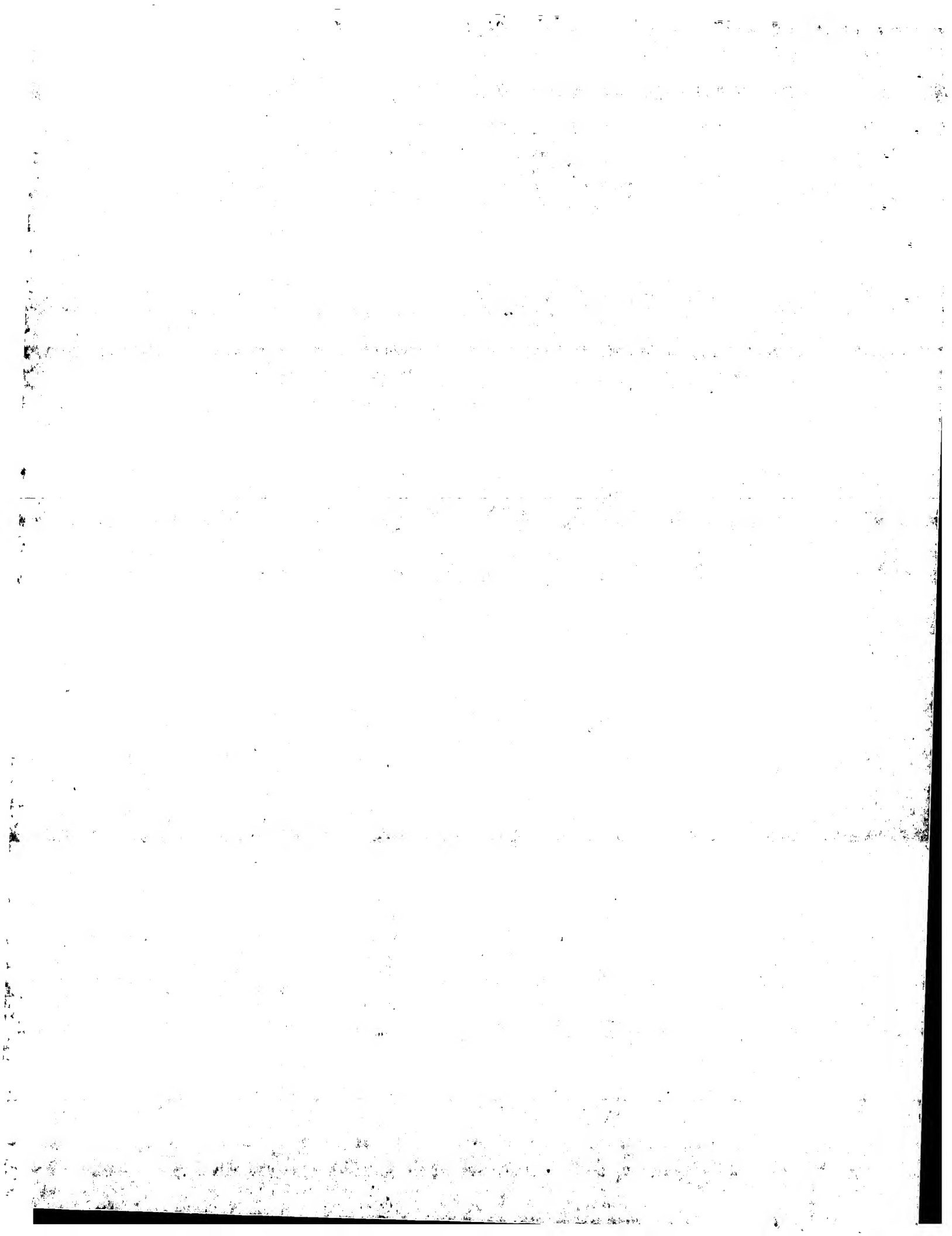
In accordance with the present invention a core may have an average unit weight of not more than about 120 pounds per cubic foot

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In accordance with the present invention first and second broad face mesh components may be of a non-woven oriented mesh and the U-shaped edge reinforcing mesh component may be of a non-woven non-oriented reinforcing mesh.

20

In accordance with the present invention a panel may be provided with reinforced broad side face as follows: the web



of fabric is deposited onto a supporting web member (e.g., a plastic protective film), a cementitious slurry is fed to the upper surface of the web and then is spread uniformly over the web in controlled amount by means of a doctor (blade, bar or roller) adjustably spaced from the supporting member. The web
5 is drawn out of the slot formed by the doctor and supporting member, thereby applying the desired coating of slurry to the first reinforcing mesh; the core mix is then applied. Then the second web is deposited upon the upper face of the core layer; vibrating the layer of slurry in contact with the
10 fabric or web until slurry penetrates the web and the latter is completely embedded.

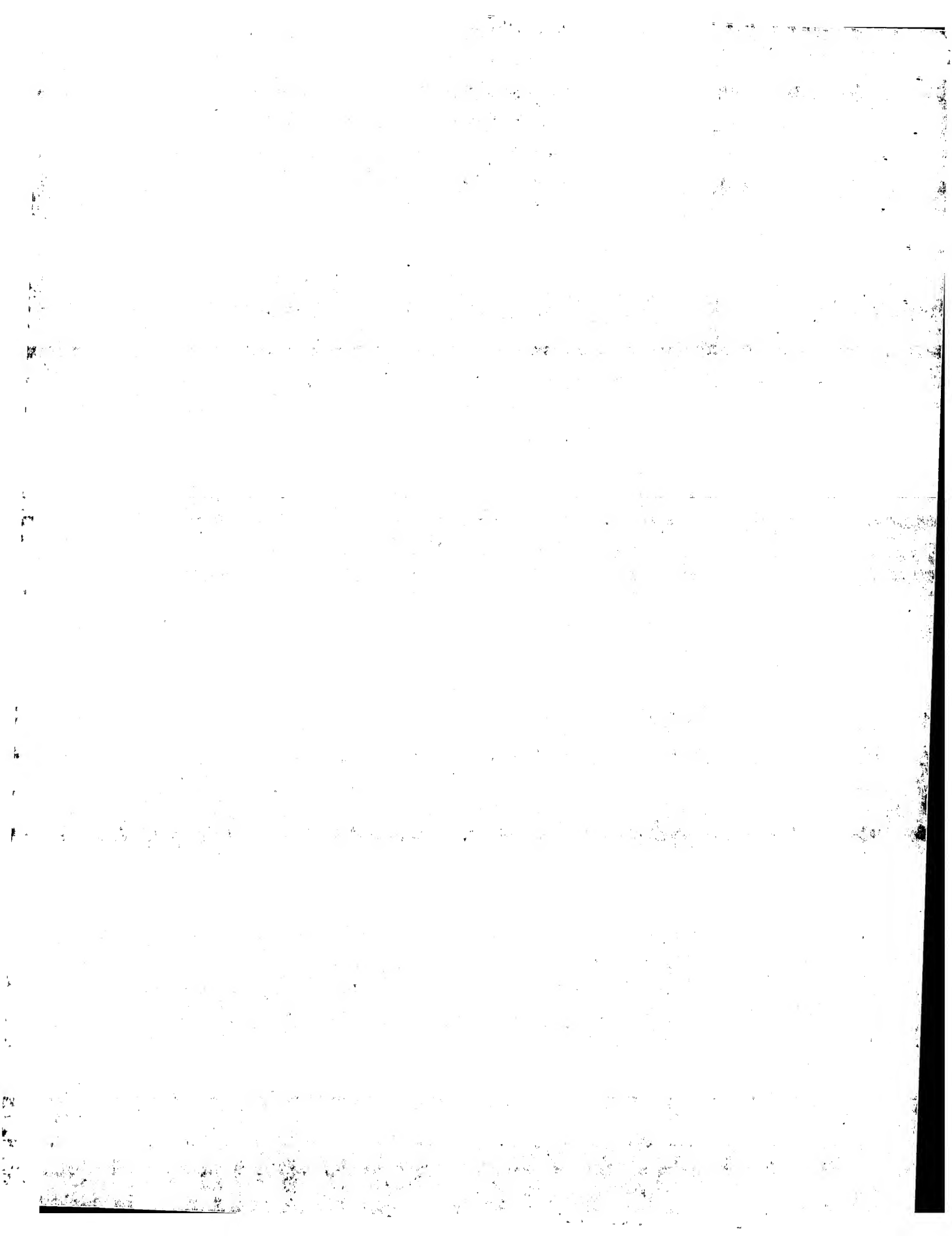
In accordance with a different aspect the present invention provides a method for manufacturing a reinforced cementitious
15 panel having a reinforced longitudinal edge comprising:

forming a first slurry comprising a cementitious material and water ;

forming a core mix comprising a cementitious material, lightweight aggregate and water

20 providing a panel forming support substrate;

laying over said panel forming support substrate a band of reinforcing mesh;



laying a first sheet of reinforcing mesh over said panel forming support substrate such that said sheet of reinforcing mesh overlaps said band at an outer marginal portion of said first sheet of reinforcing mesh,

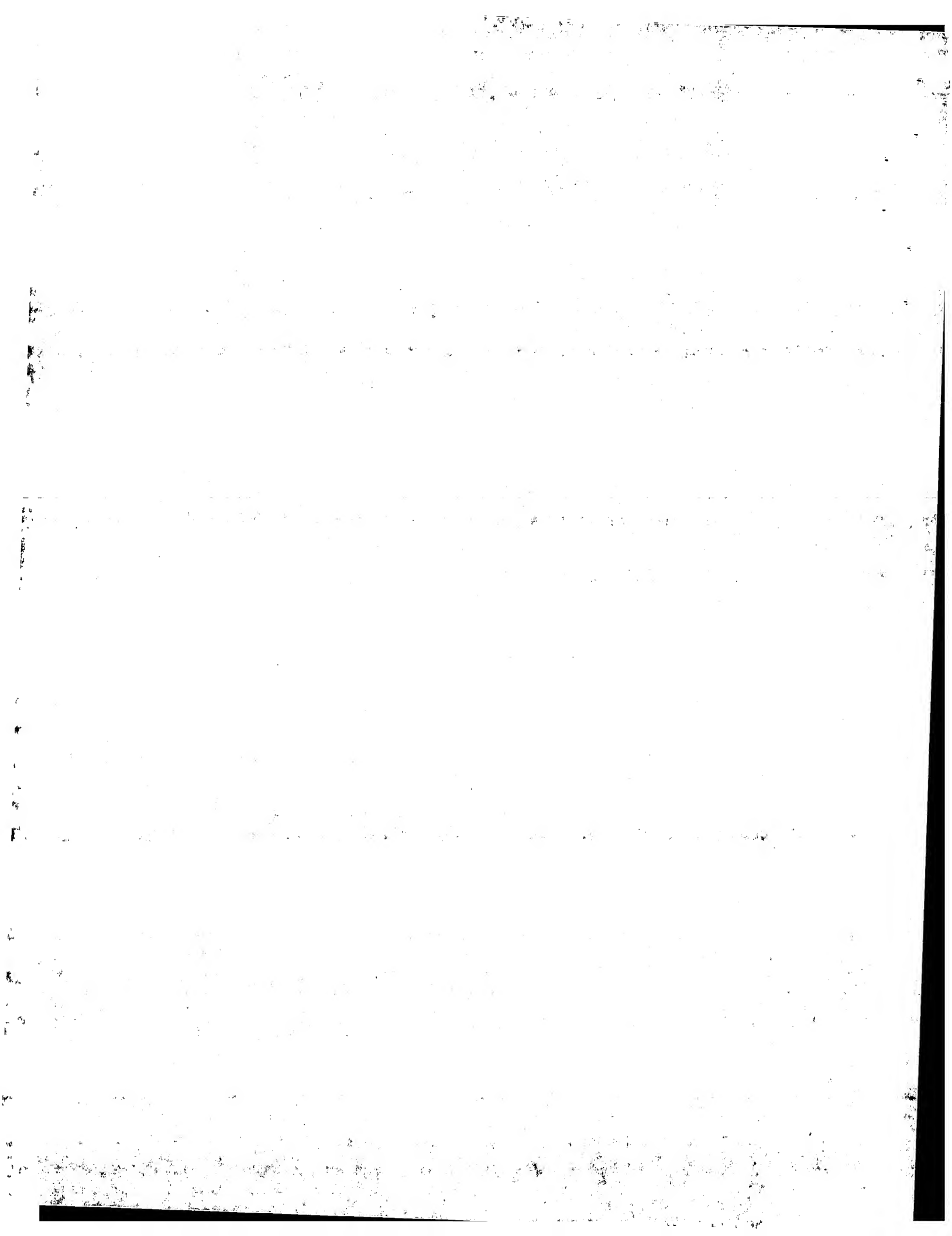
depositing said first slurry on said first sheet of reinforcing mesh and distributing it across the breadth of said first sheet of reinforcing mesh so as to form a slurried reinforcement layer of predetermined thickness such that the first sheet of reinforcing mesh is embedded in said slurried reinforcement layer;

depositing said core mix on said slurried reinforcement layer and distributing the core mix across said first sheet of reinforcing mesh so as to form a core layer of predetermined depth having an upper broad surface

laying a second sheet of reinforcing mesh over said core layer such that said second sheet of reinforcing mesh is embedded in said upper broad surface and overlies said first sheet of reinforcing mesh.

In accordance with another aspect the present invention provides a method for manufacturing a reinforced cementitious panel having a reinforced longitudinal edge comprising:

forming a first slurry comprising a cementitious material



and water;

forming a core mix comprising a cementitious material,
lightweight aggregate and water

providing a panel forming support substrate;

laying a first sheet of reinforcing mesh over said panel
5 forming support substrate,

depositing said first slurry on said first sheet of
reinforcing mesh and distributing it across the breadth of
said first sheet of reinforcing mesh so as to form a slurried
reinforcement layer of predetermined thickness such that the
10 first sheet of reinforcing mesh is embedded in said slurried
reinforcement layer;

depositing said core mix on said slurried reinforcement
layer and distributing the core mix across said first sheet of
reinforcing mesh so as to form a core layer of predetermined
15 depth having an upper broad surface

laying a second long sheet of reinforcing mesh over said
core layer such that said second sheet of reinforcing mesh is
embedded in said upper broad surface and overlies said first
sheet of reinforcing mesh

20 laying over said upper broad surface a band of
reinforcing mesh such that said band overlaps said second
sheet of reinforcing mesh band at an outer marginal portion of

said panel and first sheet of reinforcing mesh and is embedded in said upper broad surface.

In accordance with an additional aspect the present invention provides a method for manufacturing a reinforced cementitious panel having a reinforced longitudinal edge comprising:

forming a first slurry comprising a cementitious material and water ;

forming a core mix comprising a cementitious material, lightweight aggregate and water

providing a panel forming support substrate, said panel forming support substrate being wider than the panel to be made;

laying over said panel forming support substrate a band of reinforcing mesh;

laying a first sheet of reinforcing mesh over said panel forming support substrate such that said first sheet of reinforcing mesh overlaps a predetermined portion of said first band so as to leave an outer portion of said band uncovered by said first sheet of reinforcing mesh,

depositing said first slurry on said first sheet of reinforcing mesh and distributing it across the breadth of said first sheet of reinforcing mesh so as to form a slurried

reinforcement layer of predetermined thickness such that the first sheet of reinforcing mesh is embedded in said slurried reinforcement layer;

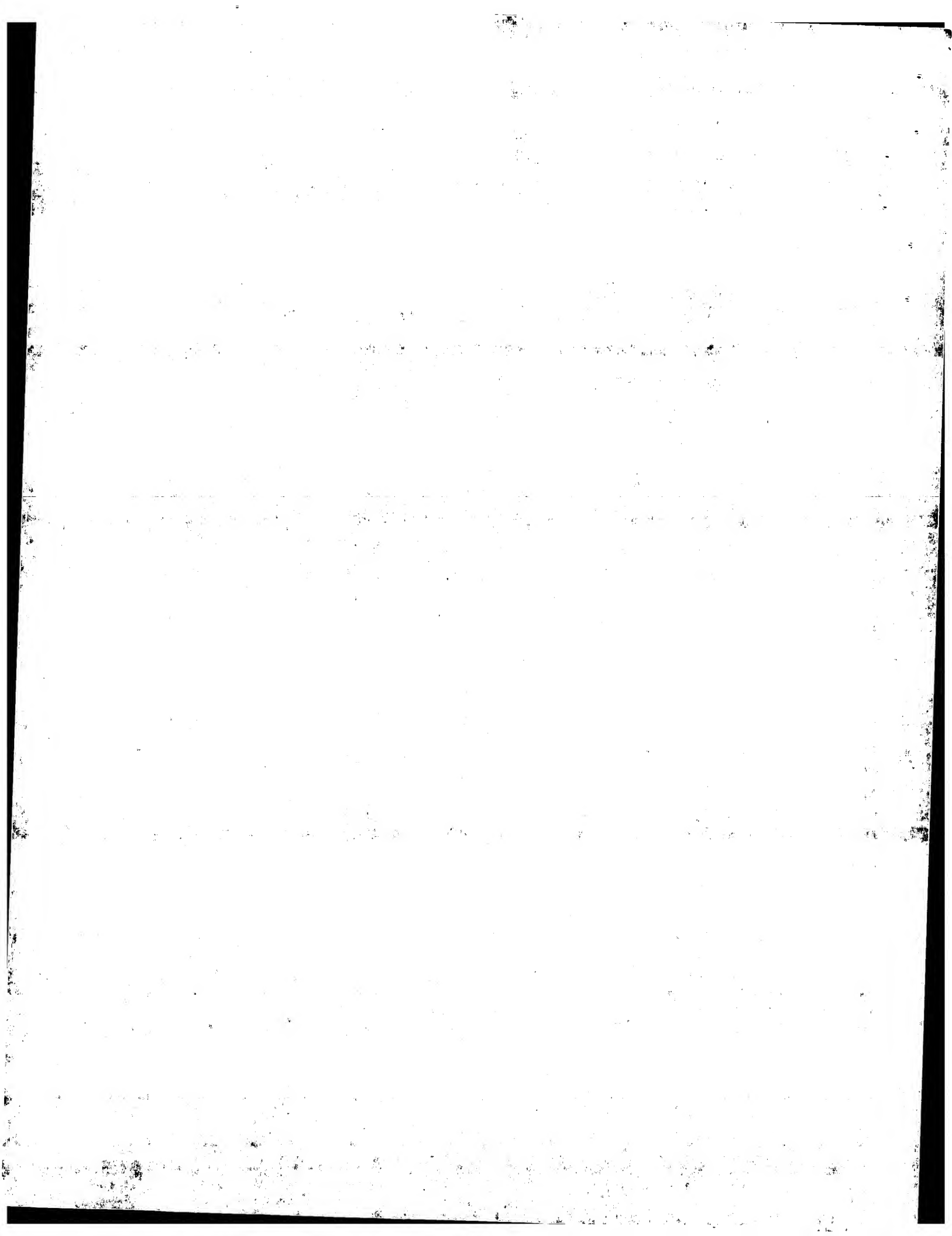
depositing said core mix on said slurried reinforcement layer and distributing the core mix across said first sheet of reinforcing mesh so as to form a core layer of predetermined
5 depth having an upper broad surface

laying a second indefinitely long sheet of reinforcing mesh over said core layer such that said second sheet of reinforcing mesh is embedded in said upper broad surface and
10 overlies said first sheet of reinforcing mesh,

bending the outer marginal portions of said band upwardly to an upright position,

folding upright portions of said band inwardly so as to overlap said second sheet of reinforcing mesh and such that
15 said band defines a U-shaped edge reinforcing mesh.

In accordance with the present invention a method for the manufacture of a panel wherein said U-shaped edge reinforcing mesh comprises first and second edge strip members and a
20 bridging member connecting said first and second edge strip members, and said bridge member is non-adhered to said core, may be carried out wherein said band has a non adhesion zone



for the formation of said bridge member.

In accordance with a further aspect the present invention provides a method for manufacturing a reinforced cementitious panel having reinforced longitudinal edges comprising:

5 forming a first slurry comprising a cementitious material and water ;

 forming a core mix comprising a cementitious material, lightweight aggregate and water

 providing a panel forming support substrate, said panel
10 forming support substrate being wider than the panel to be made;

 laying over said panel forming support substrate, in spaced apart parallel relation, a first band of reinforcing mesh and second band of reinforcing mesh;

15 laying a first sheet of reinforcing mesh over said panel forming support substrate such that said first sheet of reinforcing mesh overlaps a predetermined portion of each of said first and second bands so as to leave an outer portion of each band uncovered by said first sheet of reinforcing mesh,

20 depositing said first slurry on said first sheet of reinforcing mesh and distributing it across the breadth of said first sheet of reinforcing mesh so as to form a slurried

reinforcement layer of predetermined thickness such that the first sheet of reinforcing mesh is embedded in said slurried reinforcement layer;

depositing said core mix on said slurried reinforcement layer and distributing the core mix across said first sheet of reinforcing mesh so as to form a core layer of predetermined depth having an upper broad surface

laying a second indefinitely long sheet of reinforcing mesh over said core layer such that said second sheet of reinforcing mesh is embedded in said upper broad surface and overlies said first sheet of reinforcing mesh,

bending the outer marginal portions of said first and second bands upwardly to an upright position,

folding upright portions of said first and second bands inwardly so as to overlap said second sheet of reinforcing mesh and such that each of said first and second bands define a U-shaped edge reinforcing mesh.

In accordance with another aspect the present invention provides a method for manufacturing a reinforced cementitious panel having reinforced longitudinal edges comprising:

continuously forming a first slurry comprising a cementitious material and water ;

continuously forming a core mix comprising a cementitious material, lightweight aggregate and water

continuously advancing an indefinitely long panel forming support substrate over a support surface, said panel forming support substrate being wider than the panel to be made;

5 continuously laying over said panel forming support substrate, in spaced apart parallel relation, an indefinitely long first band of reinforcing mesh and an indefinitely long second band of reinforcing mesh;

continuously laying a first indefinitely long sheet of reinforcing mesh over said panel forming support substrate
10 such that said first sheet of reinforcing mesh overlaps a predetermined portion of each of said first and second bands so as to leave an outer portion of each band uncovered by said first sheet of reinforcing mesh,

15 continuously depositing said first slurry on said first sheet of reinforcing mesh and distributing it across the breadth of said first sheet of reinforcing mesh so as to form a slurried reinforcement layer of predetermined thickness such that the first sheet of reinforcing mesh is embedded in said
20 slurried reinforcement layer;

continuously depositing said core mix on said slurried reinforcement layer and distributing the core mix across said

first sheet of reinforcing mesh so as to form a core layer of predetermined depth having an upper broad surface

continuously laying a second indefinitely long sheet of reinforcing mesh over said core layer such that said second sheet of reinforcing mesh is embedded in said upper broad surface so as to leave an outer marginal portion of each of said bands uncovered by said second sheet of reinforcing mesh, continuously bending the outer marginal portions of said first and second bands upwardly to an upright position,

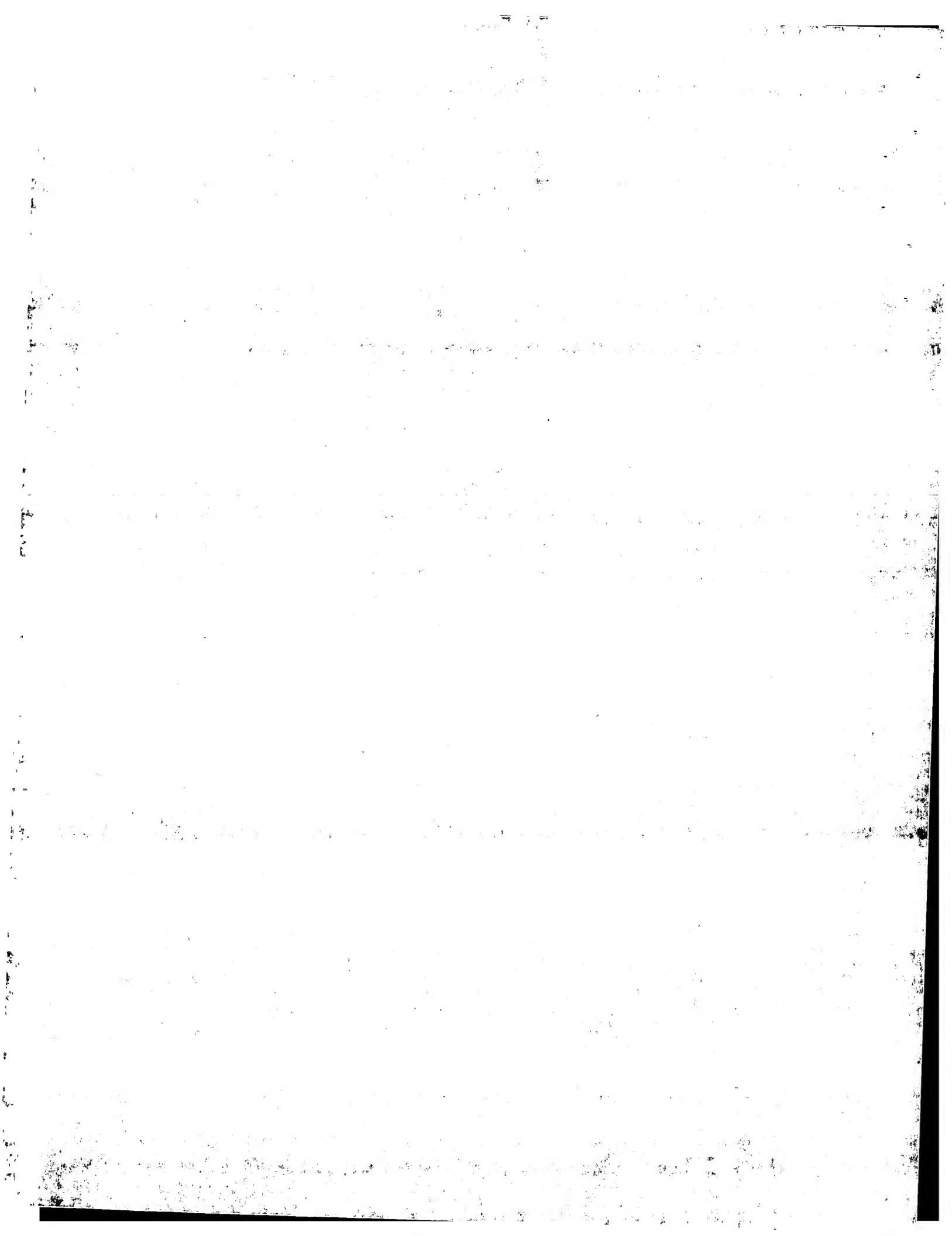
folding upright portions of said first and second bands inwardly so as to overlap said second indefinitely long sheet of reinforcing mesh and such that each of said first and second bands define a U-shaped edge reinforcing mesh.

In accordance with a different aspect the present invention provides an apparatus for manufacturing a reinforced cementitious panel having reinforced longitudinal edges comprising

means for forming a first slurry comprising a cementitious material and water ;

means for forming a core mix comprising a cementitious material, lightweight aggregate and water

means for providing a panel forming support substrate;



means for laying over said panel forming support substrate a band of reinforcing mesh;

means for laying a first sheet of reinforcing mesh over said panel forming support substrate such that said sheet of reinforcing mesh overlaps said band at an outer marginal
5 portion of said first sheet of reinforcing mesh,

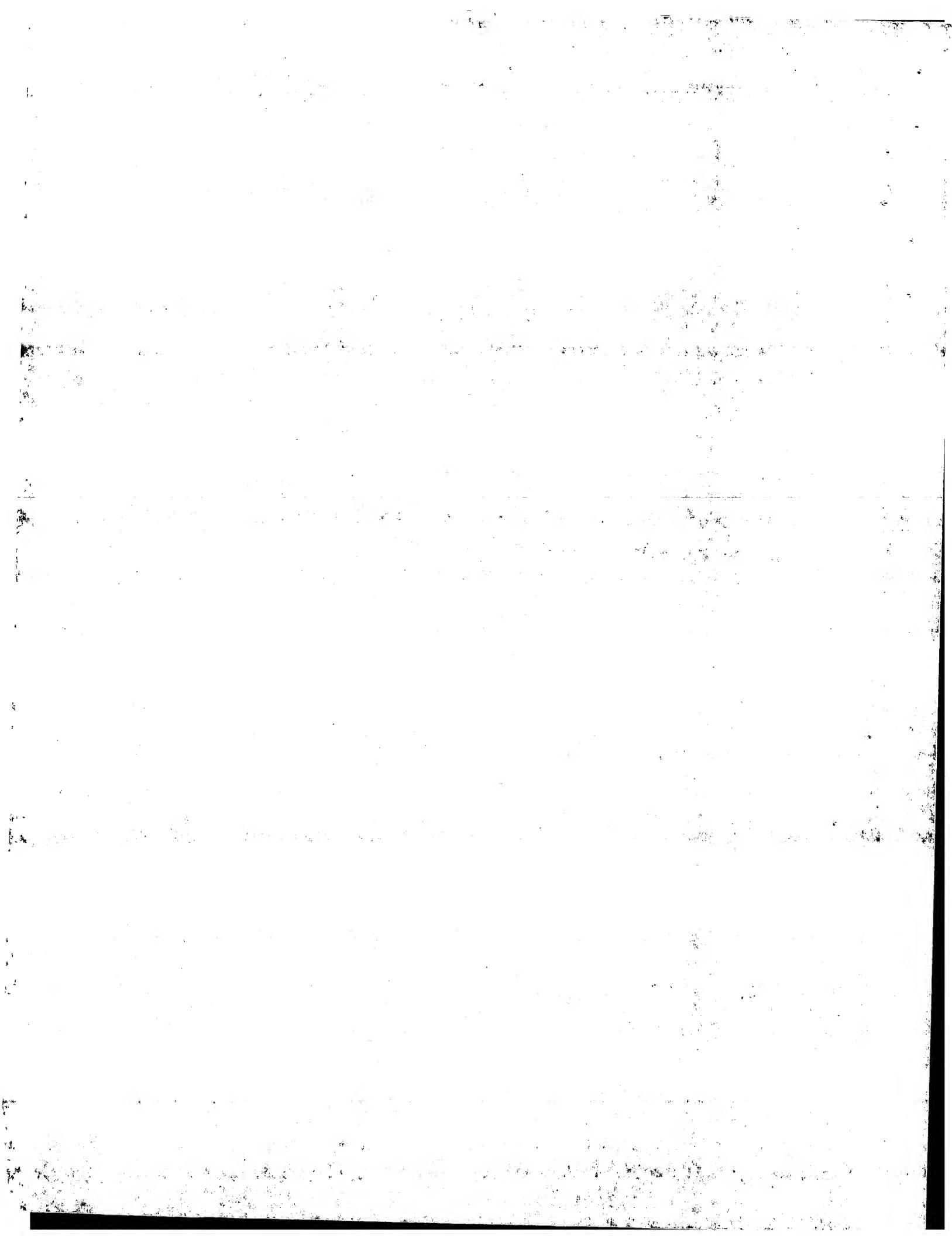
means for depositing said first slurry on said first sheet of reinforcing mesh and distributing it across the breadth of said first sheet of reinforcing mesh so as to form a slurried reinforcement layer of predetermined thickness such
10 that the first sheet of reinforcing mesh is embedded in said slurried reinforcement layer;

means for depositing said core mix on said slurried reinforcement layer and distributing the core mix across said first sheet of reinforcing mesh so as to form a core layer of
15 predetermined depth having an upper broad surface

means for laying a second sheet of reinforcing mesh over said core layer such that said second sheet of reinforcing mesh is embedded in said upper broad surface and overlies said
first sheet of reinforcing mesh.

20

In accordance with another aspect the present invention provides a method for manufacturing a reinforced cementitious



panel having a reinforced longitudinal edge comprising:

means for forming a first slurry comprising a cementitious material and water ;

means for forming a core mix comprising a cementitious material, lightweight aggregate and water

5 means for providing a panel forming support substrate;

means for laying a first sheet of reinforcing mesh over said panel forming support substrate,

means for depositing said first slurry on said first sheet of reinforcing mesh and distributing it across the breadth of said first sheet of reinforcing mesh so as to form a slurried reinforcement layer of predetermined thickness such that the first sheet of reinforcing mesh is embedded in said slurried reinforcement layer;

means for depositing said core mix on said slurried reinforcement layer and distributing the core mix across said first sheet of reinforcing mesh so as to form a core layer of predetermined depth having an upper broad surface

means for laying a second long sheet of reinforcing mesh over said core layer such that said second sheet of reinforcing mesh is embedded in said upper broad surface and overlies said first sheet of reinforcing mesh

means for laying over said upper broad surface a band of

reinforcing mesh such that said band overlaps said second sheet of reinforcing mesh band at an outer marginal portion of said panel and first sheet of reinforcing mesh and is embedded in said upper broad surface.

- 5 In accordance with an additional aspect the present invention provides an apparatus for manufacturing a reinforced cementitious panel having a reinforced longitudinal edge comprising:

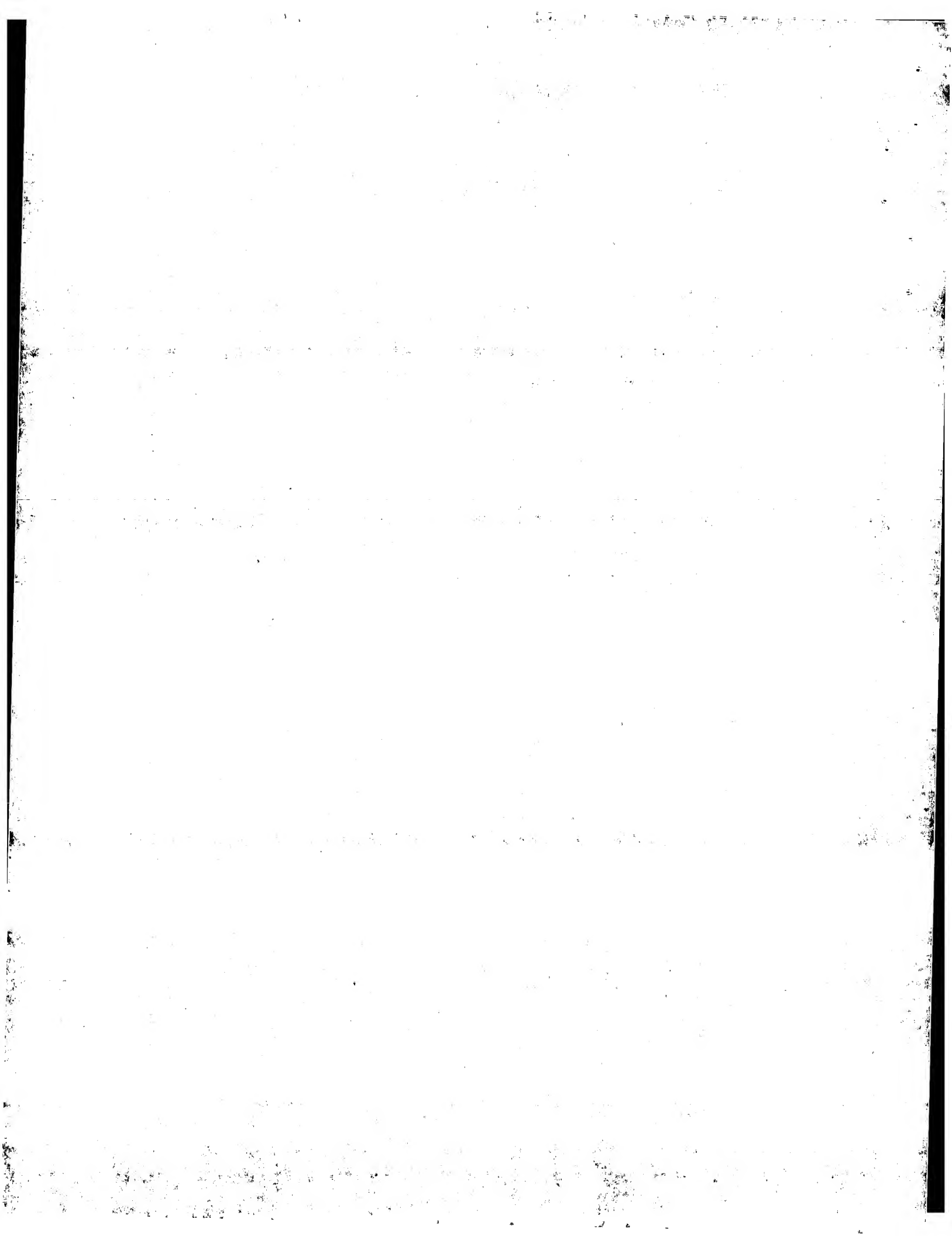
means for forming a first slurry comprising a
10 cementitious material and water ;

means for forming a core mix comprising a cementitious material, lightweight aggregate and water

means for providing a panel forming support substrate,
said panel forming support substrate being wider than the
15 panel to be made;

means for laying over said panel forming support substrate a band of reinforcing mesh;

means for laying a first sheet of reinforcing mesh over
said panel forming support substrate such that said first
20 sheet of reinforcing mesh overlaps a predetermined portion of said first band so as to leave an outer portion of said band uncovered by said first sheet of reinforcing mesh,



means for depositing said first slurry on said first sheet of reinforcing mesh and distributing it across the breadth of said first sheet of reinforcing mesh so as to form a slurried reinforcement layer of predetermined thickness such that the first sheet of reinforcing mesh is embedded in said slurried reinforcement layer;

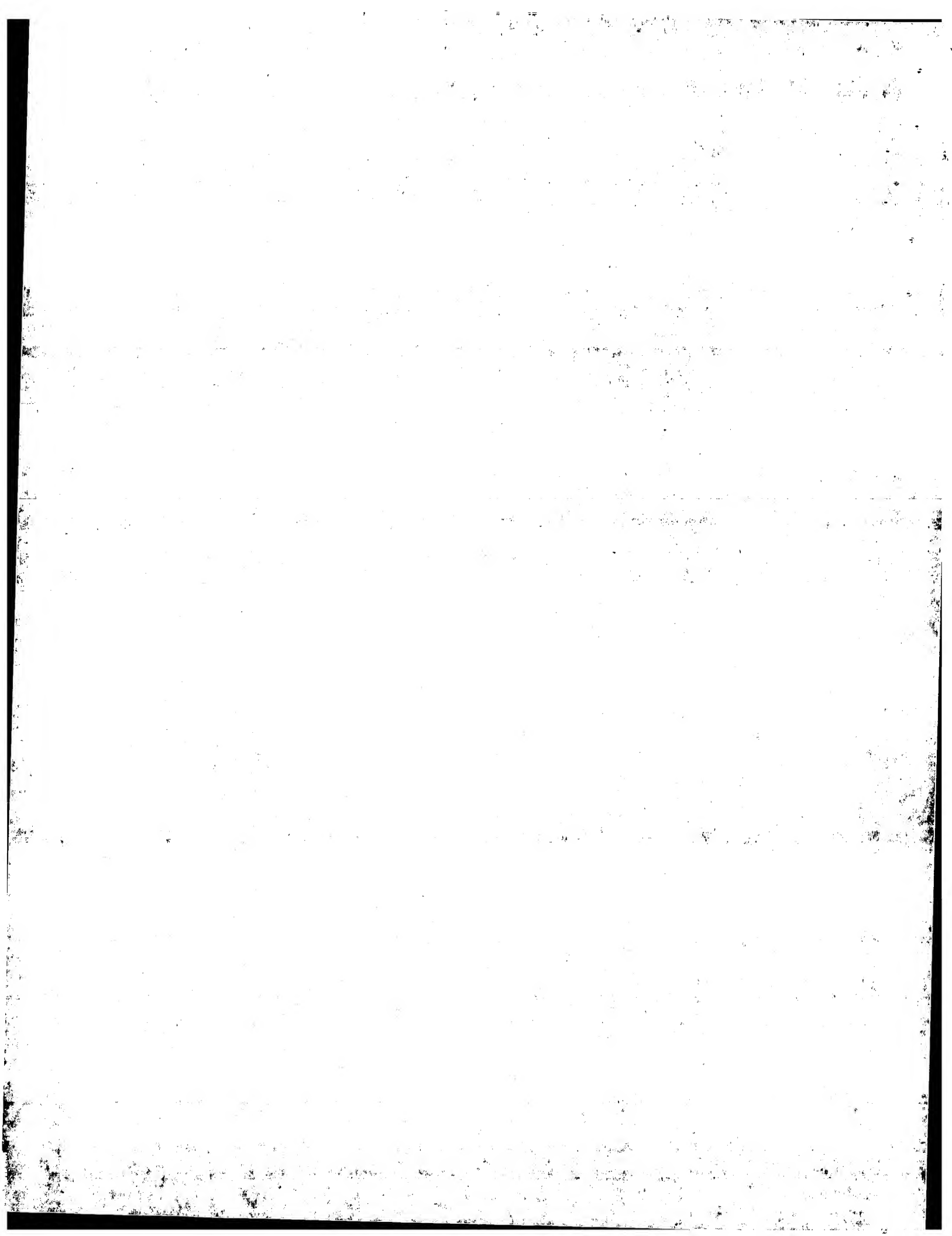
means for depositing said core mix on said slurried reinforcement layer and distributing the core mix across said first sheet of reinforcing mesh so as to form a core layer of predetermined depth having an upper broad surface

means for laying a second indefinitely long sheet of reinforcing mesh over said core layer such that said second sheet of reinforcing mesh is embedded in said upper broad surface and overlies said first sheet of reinforcing mesh,

means for bending the outer marginal portions of said band upwardly to an upright position,

means for folding upright portions of said band inwardly so as to overlap said second sheet of reinforcing mesh and such that said band defines a U-shaped edge reinforcing mesh.

In accordance with the present invention an for the manufacture of a panel wherein said U-shaped edge reinforcing mesh comprises first and second edge strip members and a



bridging member connecting said first and second edge strip members, and said bridge member is non-adhered to said core, may be used wherein the apparatus includes means for applying a non adhesion zone to said band for the formation of said bridge member.

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In accordance with a further aspect the present invention provides an apparatus for manufacturing a reinforced cementitious panel having reinforced longitudinal edges comprising:

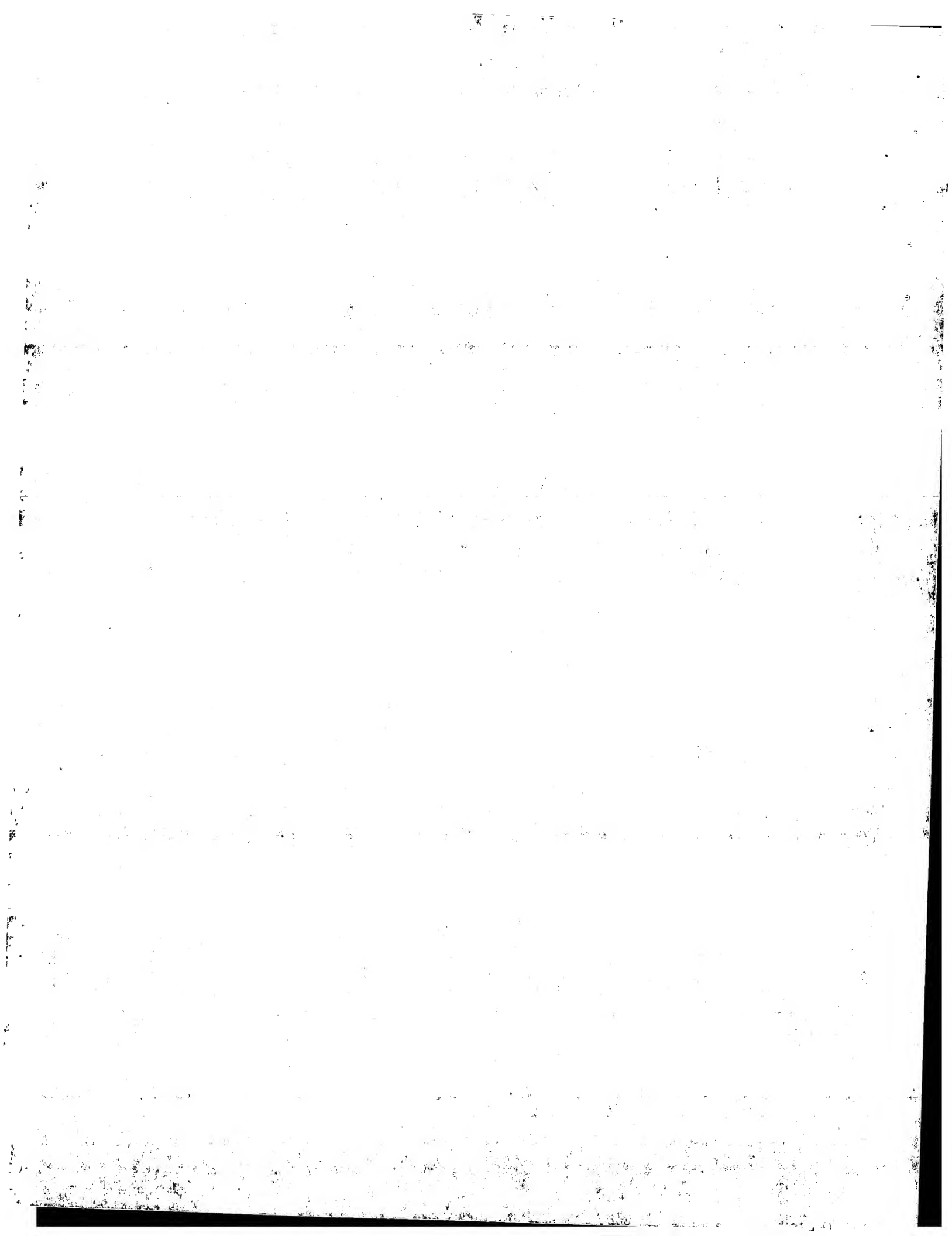
10 means for forming a first slurry comprising a cementitious material and water ;

 means for forming a core mix comprising a cementitious material, lightweight aggregate and water

 means for providing a panel forming support substrate,
15 said panel forming support substrate being wider than the panel to be made;

 means for laying over said panel forming support substrate, in spaced apart parallel relation, a first band of reinforcing mesh and second band of reinforcing mesh;

20 means for laying a first sheet of reinforcing mesh over said panel forming support substrate such that said first sheet of reinforcing mesh overlaps a predetermined portion of



each of said first and second bands so as to leave an outer portion of each band uncovered by said first sheet of reinforcing mesh,

means for depositing said first slurry on said first sheet of reinforcing mesh and distributing it across the
5 breadth of said first sheet of reinforcing mesh so as to form a slurried reinforcement layer of predetermined thickness such that the first sheet of reinforcing mesh is embedded in said slurried reinforcement layer;

means for depositing said core mix on said slurried
10 reinforcement layer and distributing the core mix across said first sheet of reinforcing mesh so as to form a core layer of predetermined depth having an upper broad surface

means for laying a second indefinitely long sheet of reinforcing mesh over said core layer such that said second
15 sheet of reinforcing mesh is embedded in said upper broad surface and overlies said first sheet of reinforcing mesh,

means for bending the outer marginal portions of said first and second bands upwardly to an upright position,

means for folding upright portions of said first and
20 second bands inwardly so as to overlap said second sheet of reinforcing mesh and such that each of said first and second bands define a U-shaped edge reinforcing mesh.

In accordance with another aspect the present invention provides an apparatus for manufacturing a reinforced cementitious panel having reinforced longitudinal edges comprising:

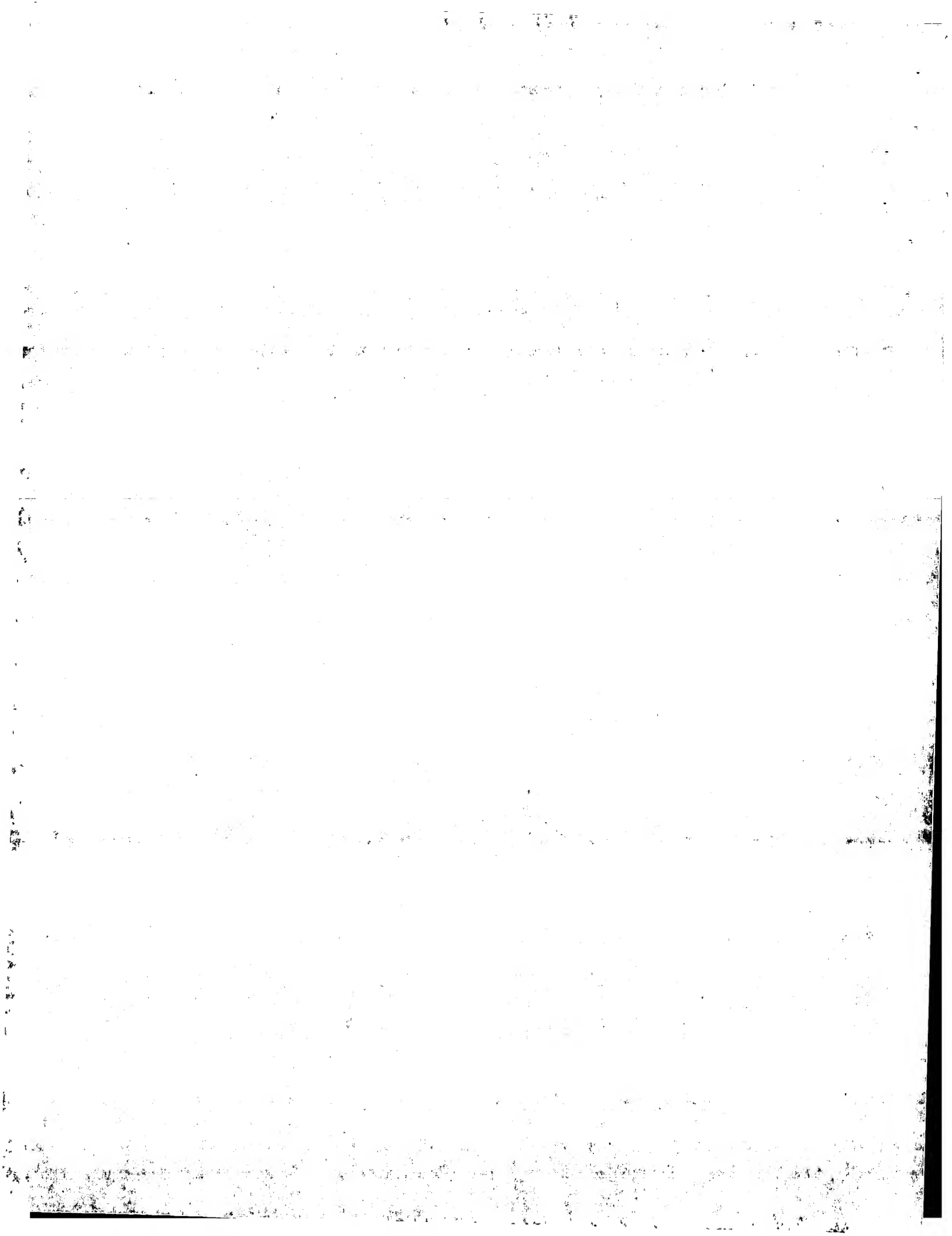
5 means for continuously forming a first slurry comprising a cementitious material and water ;

means for continuously forming a core mix comprising a cementitious material, lightweight aggregate and water

means for continuously advancing an indefinitely long panel forming support substrate over a support surface, said
10 panel forming support substrate being wider than the panel to be made;

means for continuously laying over said panel forming support substrate, in spaced apart parallel relation, an indefinitely long first band of reinforcing mesh and an
15 indefinitely long second band of reinforcing mesh;

means for continuously laying a first indefinitely long sheet of reinforcing mesh over said panel forming support substrate such that said first sheet of reinforcing mesh overlaps a predetermined portion of each of said first and
20 second bands so as to leave an outer portion of each band uncovered by said first sheet of reinforcing mesh,



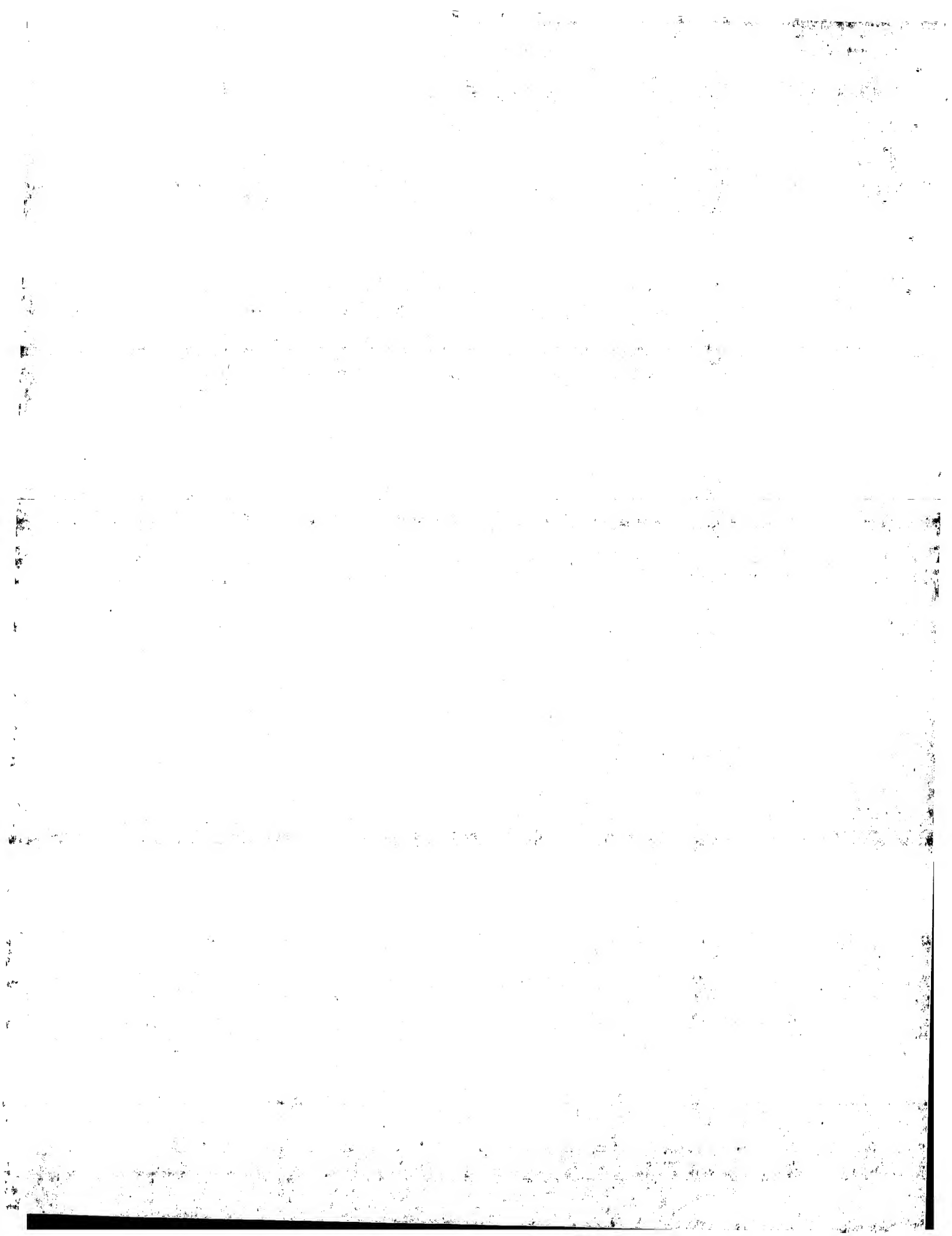
means for continuously depositing said first slurry on said first sheet of reinforcing mesh and distributing it across the breadth of said first sheet of reinforcing mesh so as to form a slurried reinforcement layer of predetermined thickness such that the first sheet of reinforcing mesh is embedded in said slurried reinforcement layer;

means for continuously depositing said core mix on said slurried reinforcement layer and distributing the core mix across said first sheet of reinforcing mesh so as to form a core layer of predetermined depth having an upper broad surface

means for continuously laying a second indefinitely long sheet of reinforcing mesh over said core layer such that said second sheet of reinforcing mesh is embedded in said upper broad surface so as to leave an outer marginal portion of each of said bands uncovered by said second sheet of reinforcing mesh,

means for continuously bending the outer marginal portions of said first and second bands upwardly to an upright position,

means for folding upright portions of said first and second bands inwardly so as to overlap said second indefinitely long sheet of reinforcing mesh and such that each



of said first and second bands define a U-shaped edge reinforcing mesh.

In accordance with the present invention a bridge member may be non-embedded in a longitudinal side edge face.

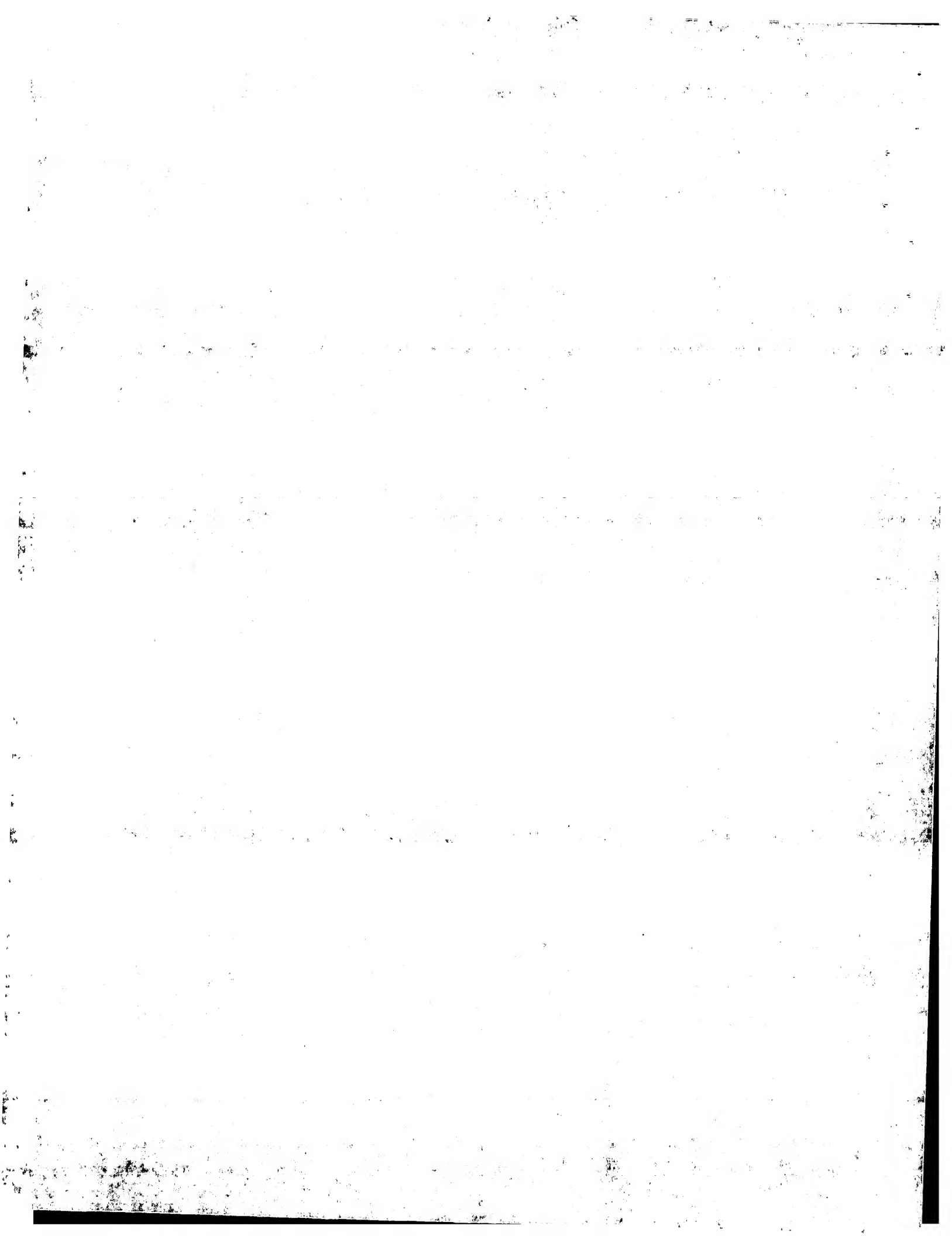
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In accordance with the present invention a support substrate may comprise a conveyor belt (supported on tab) and a protective film. If desired or necessary the protective film may be dispensed with but in such a case it may be necessary to coat a particular conveyor belt with agents such as anti-stick agents.

As mentioned above, in accordance with the present invention the first and second edge strip members of a U-shaped edge reinforcing mesh may be adhered to said core at respective marginal areas of a respective longitudinal marginal edge by being cemented thereto or as desired by being embedded in respective broad faces. A bridging member may as desired also be cemented to or as desired be embedded in a respective longitudinal edge face. On the other hand a bridging member need not if desired be adhered to a respective longitudinal edge face but may merely abut such face or as desired be

15

20



spaced apart therefrom; in this latter case the bridging member may be water impervious such that, for example, cementitious material may not pass into or through the bridging member during the manufacture of a panel such that it is possible to for example provide the exposed side of the
5 bridging member with a desired indica as described above.

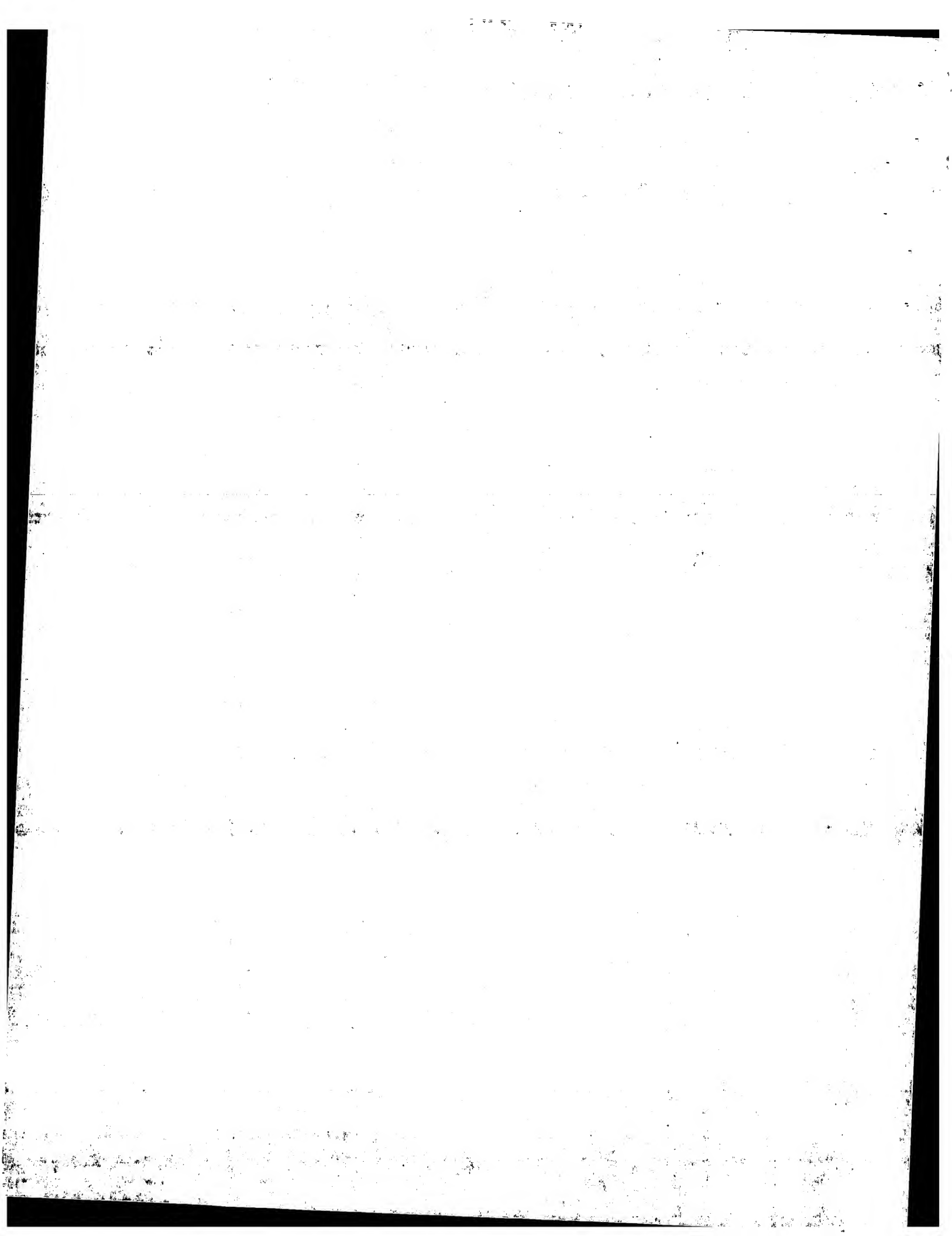
A cementitious board or panel of the present invention may be designed to be used as a backerboard for tile, thin brick, thin stones, synthetic or natural stucco, paint, exterior
10 insulation and finish systems or other finishes that can be applied onto concrete. It may be of interior or exterior grade and can be used in such places as kitchens, bath room, shower room, corridors, exterior wall, or any places that require water resistance and impact resistance. It may be
15 used to construct fire resistant partition walls.

As may be understood, in accordance with the present invention a cementitious panel may have a composite or sandwich like construction wherein a cementitious core is bounded on each of
20 its two major or broad faces by a respective reinforcing mesh component of fibrous material; each reinforcing mesh component being adhered to the panel core at a respective major face

thereof.

The longitudinal edge faces of a panel may also be covered or closed off by an edge reinforcing mesh component. The edge reinforcing mesh component may be adhered to the longitudinal edge face, merely abut the longitudinal edge face or be spaced
5 apart from the longitudinal face; this type of reinforcing mesh component may, for example take on a U-shaped configuration as discussed herein. Alternatively, if desired, the longitudinal edge face or a part thereof may be open, i.e.
10 not covered by a reinforcing mesh material. In this latter case one or both of the marginal areas adjacent a longitudinal edge on opposite broad faces may be provided with an edge reinforcing member.

15 A panel in accordance with the present invention may have a longitudinal edge face which may be more or less free of cementitious material so as to allow the longitudinal edge face to be used as a support substrate for a visual indicia such as color, images, symbols, words, etc., i.e. the
20 reinforcing mesh may be configured such that an indicia support area would not be covered up during the manufacturing process by cementitious material.



The reinforcing mesh components or members thereof whether for a broad or major face or for a longitudinal edge face may take the form of a woven or non woven fabric or mesh such as a woven mesh or scrim, a non-woven mesh, a non-woven pervious mesh or mat, etc.. Suitable fiber filaments may be formed into a woven material by the employment of a suitable method such as knitting or weaving. Suitable fiber filaments may be formed into non-woven material by the employment of a suitable method such as gluing or fusion.

10

The reinforcing mesh for a broad face may for example take the form of a woven mesh or a non-woven oriented mesh. On the other hand a mesh for a longitudinal edge face may take the form of a non-woven mesh, in particular a non-woven non-oriented mesh.

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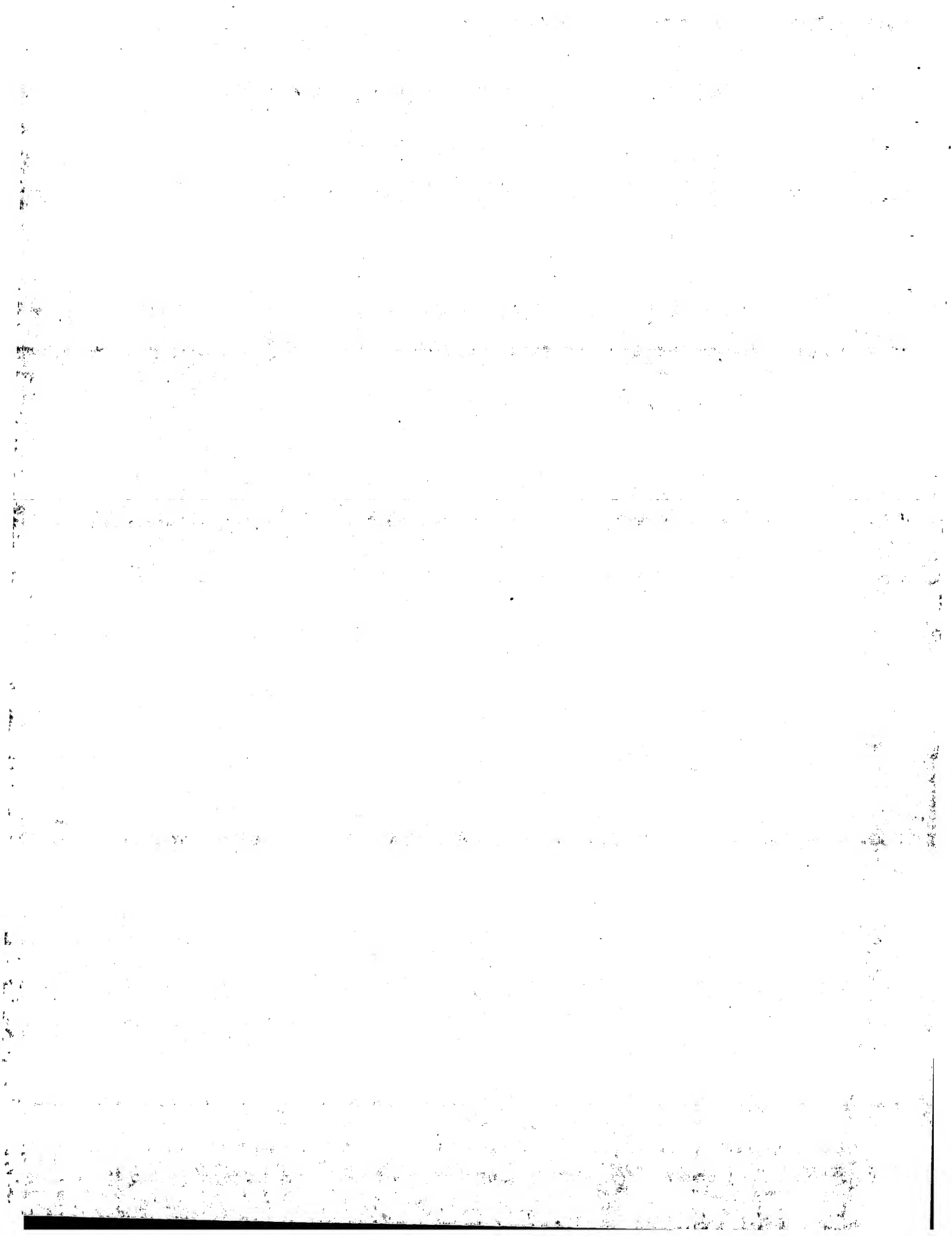
A woven mesh for a broad face may for example be composed of glass fibers and be in the form of woven or knitted fabric or scrim. When a glass fiber network is used in conjunction with an alkaline cementitious material, for example, a highly alkaline Portland, cementitious composition, the glass fibers may be made from an alkaline resistant glass or have a protective resin coating so that damage which might result

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from reaction with the alkaline cementitious material, may be minimized; this may be accomplished by coating the fibers with an alkali resistant coating such as an epoxy resin. The reinforcing mesh may, for example, be a fibre-glass scrim, in particular, a woven mesh of vinyl (e.g. polyvinylchloride) coated glass-fibre yarns.

The reinforcing mesh for a broad face may, if desired, alternatively, be in the form of a non-woven oriented fabric or web, bonded with a suitable synthetic resin or by heat. The mesh may be of non-woven oriented glass fibre tissue. A non-woven glass fibre tissue may be of resin-bonded fibers or filaments, for example fibers bonded with urea-formaldehyde and may have a weight of about 2 to 4 oz. per square yard, the fibers may for example have a diameter of e.g. 10 to 20 μm ???

However, a woven or non-woven oriented mesh of other materials may be used for reinforcing a broad face of a panel. Such a mesh may for example be of an inorganic material such as for example, of a metal (e.g. a steel fibre) of asbestos, of alumina, of zirconia, of carbon and the like. Alternatively, a mesh may be of synthetic material such as for example of organic polymeric fibers, for example, nylon fibers,



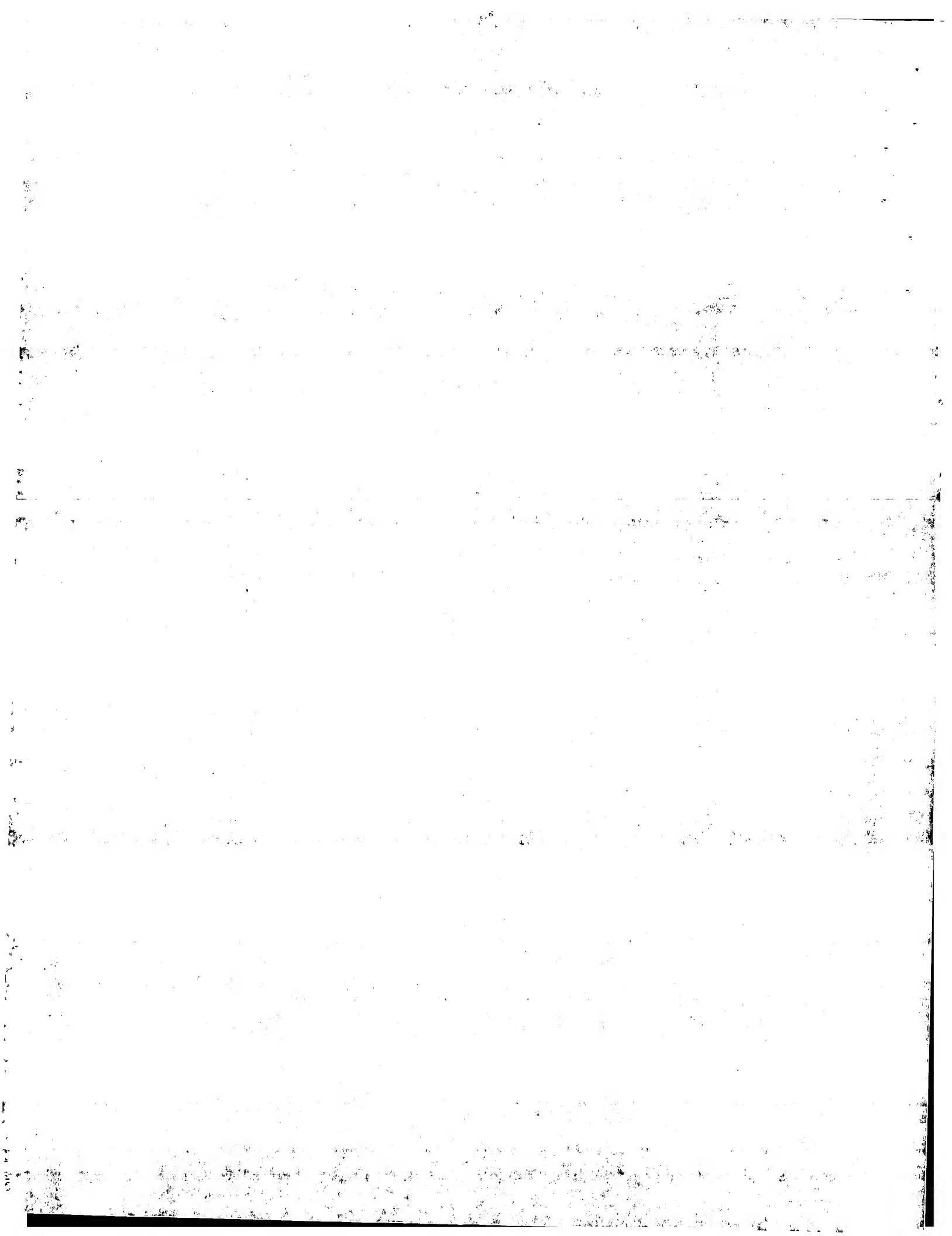
polyvinylidene chloride fibers, polyester fibre yarns coated with PVC, aramid resin fibers (e.g. as sold under the trade-mark Kevlar), polyolefin fiber, e.g. polyethylene or polypropylene; of fluorinated polyolefin, e.g. polyvinylidene fluoride or polytetrafluoroethylene; or polyamide fibre; or of
5 polyester fibre, e.g. poly(ethylene terephthalate); or of cellulosic fibre and the like.

The mesh size and the fiber diameter for a woven or non-woven
10 oriented mesh used to reinforce the broad or major faces of the core may be selected according to the strength desired in the board and the size of the aggregate in the concrete mix. A mesh for a broad face reinforcement may, for example, have a relatively loose thread or mesh count per inch (warp x fill)
15 such as for example, of from 4x4 to 18x18, of 10x8, etc. for most purposes.

In accordance with the present invention the reinforcement of the edges and margins of a cementitious board or panel may be
20 accomplished by using a separate type of woven or non-woven mesh or mat fabric as compared with the reinforcing mesh used for the broad faces; advantageously, the reinforcing mesh for

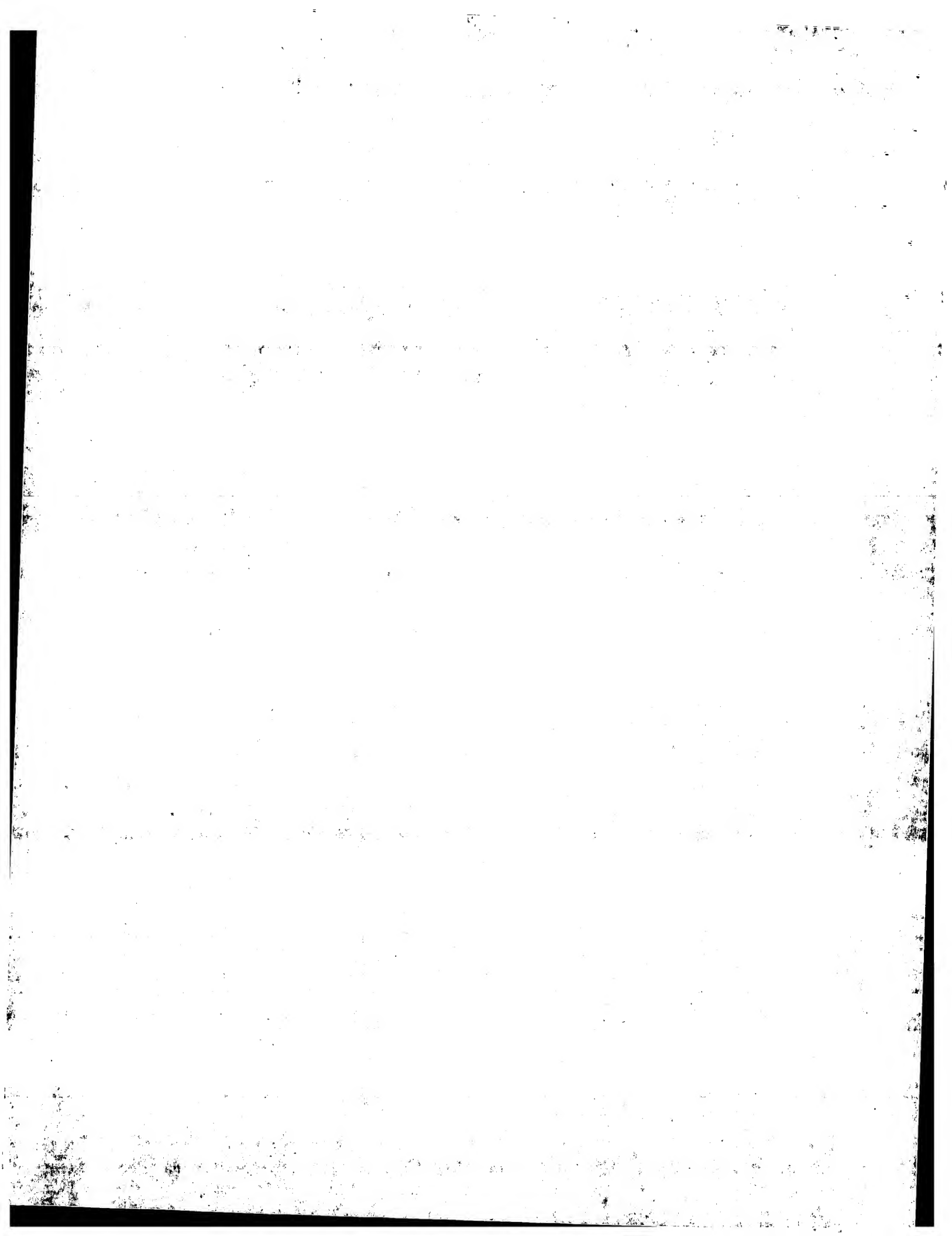
the edge face may be a non-woven non-oriented mesh. For example, a reinforcing mesh for the longitudinal edges may have relatively tight intercycles as compared with a reinforcing mesh for a broad faces ---2 to 4 oz. per sq. yd.--; the relatively tight intercycles makes attachment of the board to a wall framework with nails or screws more secure, due to of a greater amount of mesh material per unit area than is present for the central portion of the major or broad faces of the panel.

10 The fibres in a non-woven mesh for reinforcing a longitudinal marginal edge may be either randomly distributed or orientated. In the first case the longitudinal edges of the board will have substantially the same breaking strength in the longitudinal and the transverse directions. In the latter case, the longitudinal edges of the board can have high strength in the transverse direction but a lower strength in the longitudinal direction or vice versa. Thus, by varying the tissue characteristics, the edges may be made stronger in a particular direction, or additional strength can be provided in desired locations, e.g. along the board edges, by using tissues of appropriate fibre distribution.



The mesh size and the fiber diameter for a non-woven oriented mesh used to reinforce the longitudinal marginal edge face adjacent the longitudinal edge face may also be selected according to the strength desired in the longitudinal edge. However, a mesh for a longitudinal edge margin face may for
5 example have a tighter weave or intercices than is used for the broad faces, i.e. for example a thread or mesh count tighter than 10x8. Thus the reinforcing meshes for the marginal edge faces may have relatively small openings such as for example meshes with a 16x10 count per inch may be used so
10 as to secure the desired or necessary penetration of the fabric along the edge margins with the cementitious composition.

The nonwoven mesh for reinforcing a longitudinal marginal edge
15 may for example comprise fleece-like mats or felts of fibers arranged in a non-oriented manner. The nonwoven non oriented mesh reinforcing material may be three dimensional in nature with the fibers thereof defining interconnecting voids. In general, the non-oriented mesh which may be employed in the
20 reinforcement of the longitudinal marginal edges are generally those in which the voids are relatively small in size, i.e. the fibers in the mesh, mat or felt are relatively tightly



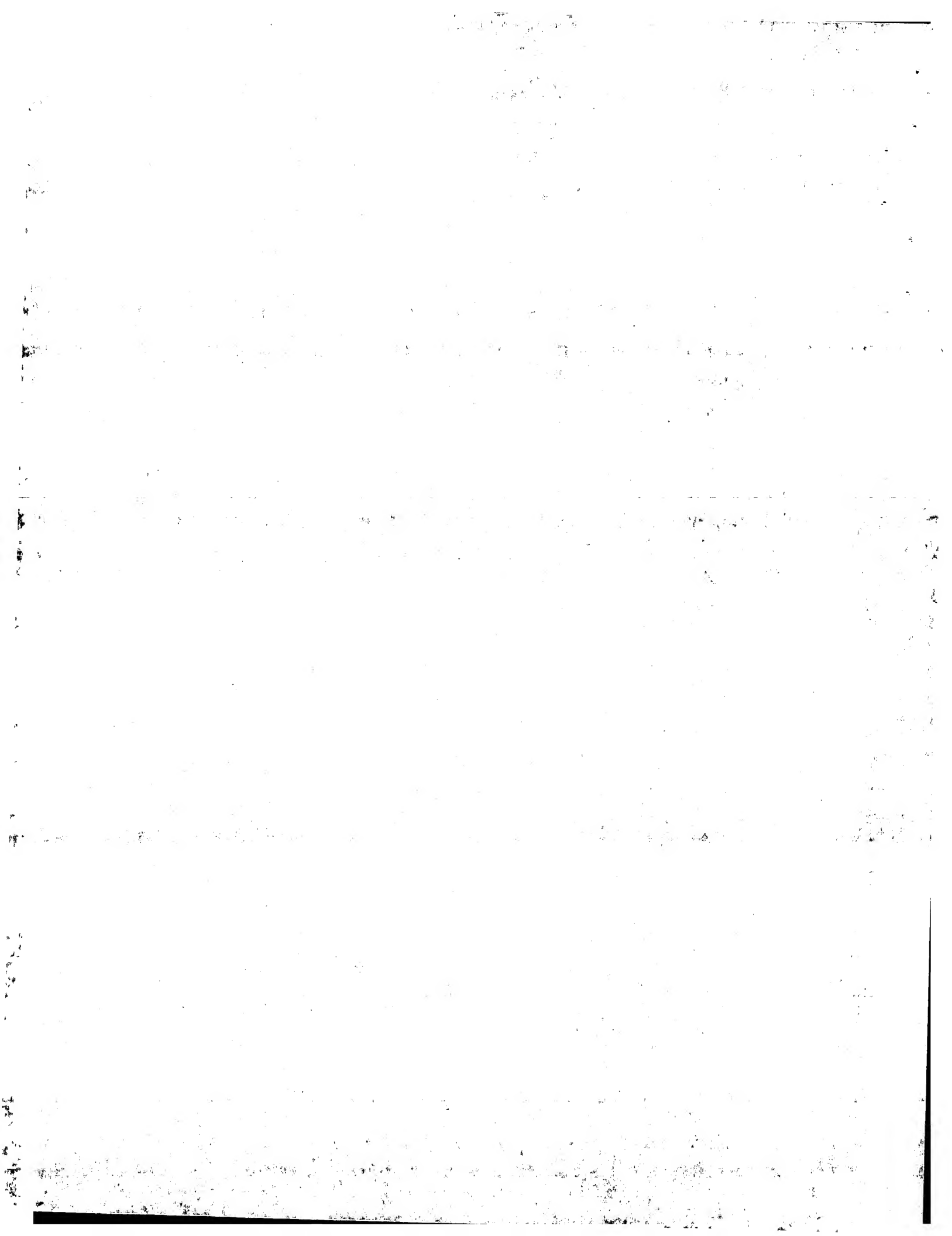
packed, e.g. of 2 to 4 oz. Per square yard.

A mesh for reinforcing a longitudinal marginal edge may be of a material as described above for the mesh for reinforcing the broad face of a panel. Such a mesh may, for example be of a synthetic material (i.e. polymer) such as described above; it may in particular be of polypropylene or of a polyester. The fibers in the non woven mesh, may be held in place by needle punching or, in the case of fibers derived from synthetic material such as an above describe polymer, by melt bonding or glueing (with a suitable adhesive) of the individual fibers to each other at points of intersection.

Illustrative of the non-woven spatial fabrics which can be employed in preparing the structures of the invention is the material synfab which is described herein below;

If desired the mat may be a mixture of two or more different types of fibre, or two or more mats of different fibrous material may be used.

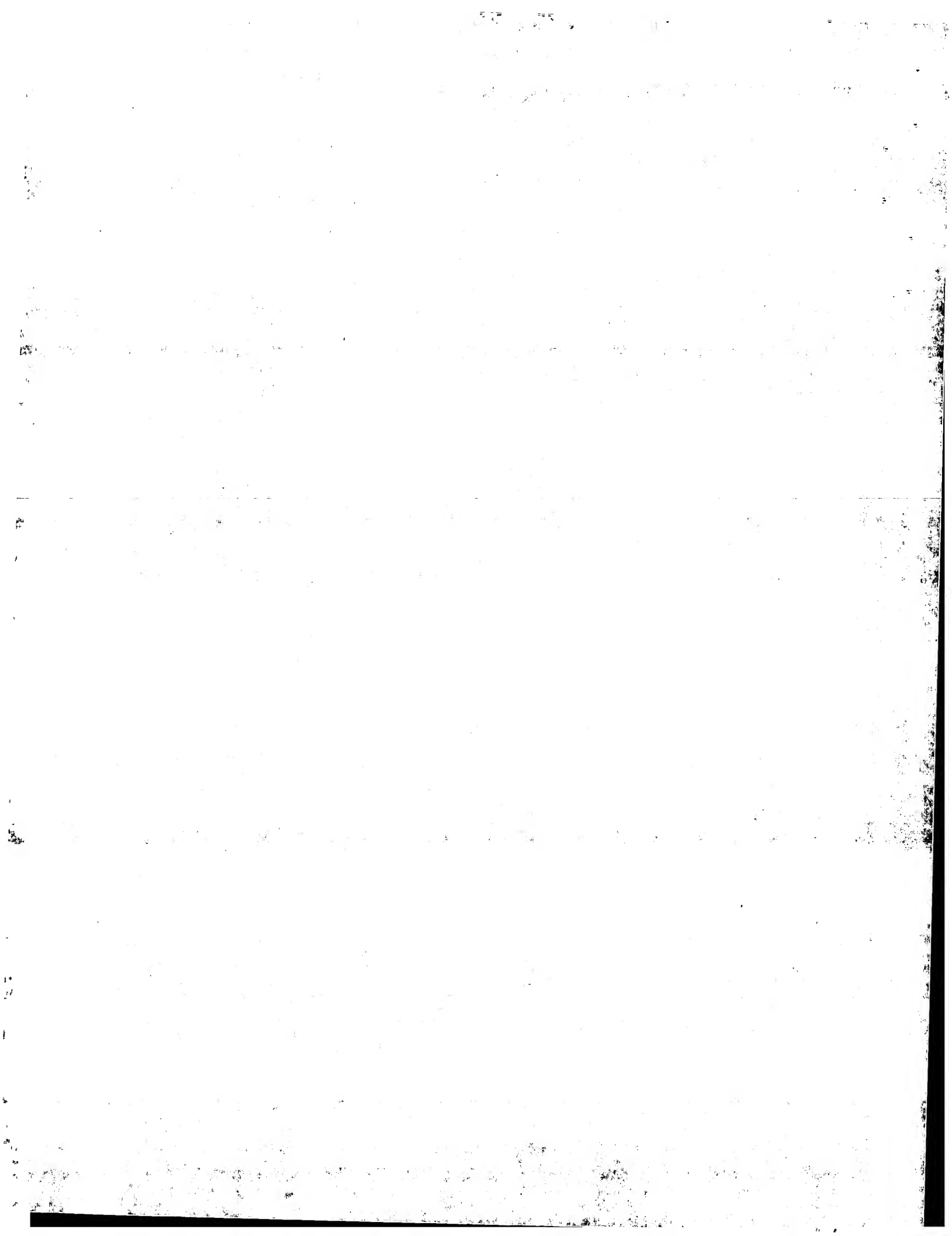
The fibres in the mat may be multi-filament or monofilament.



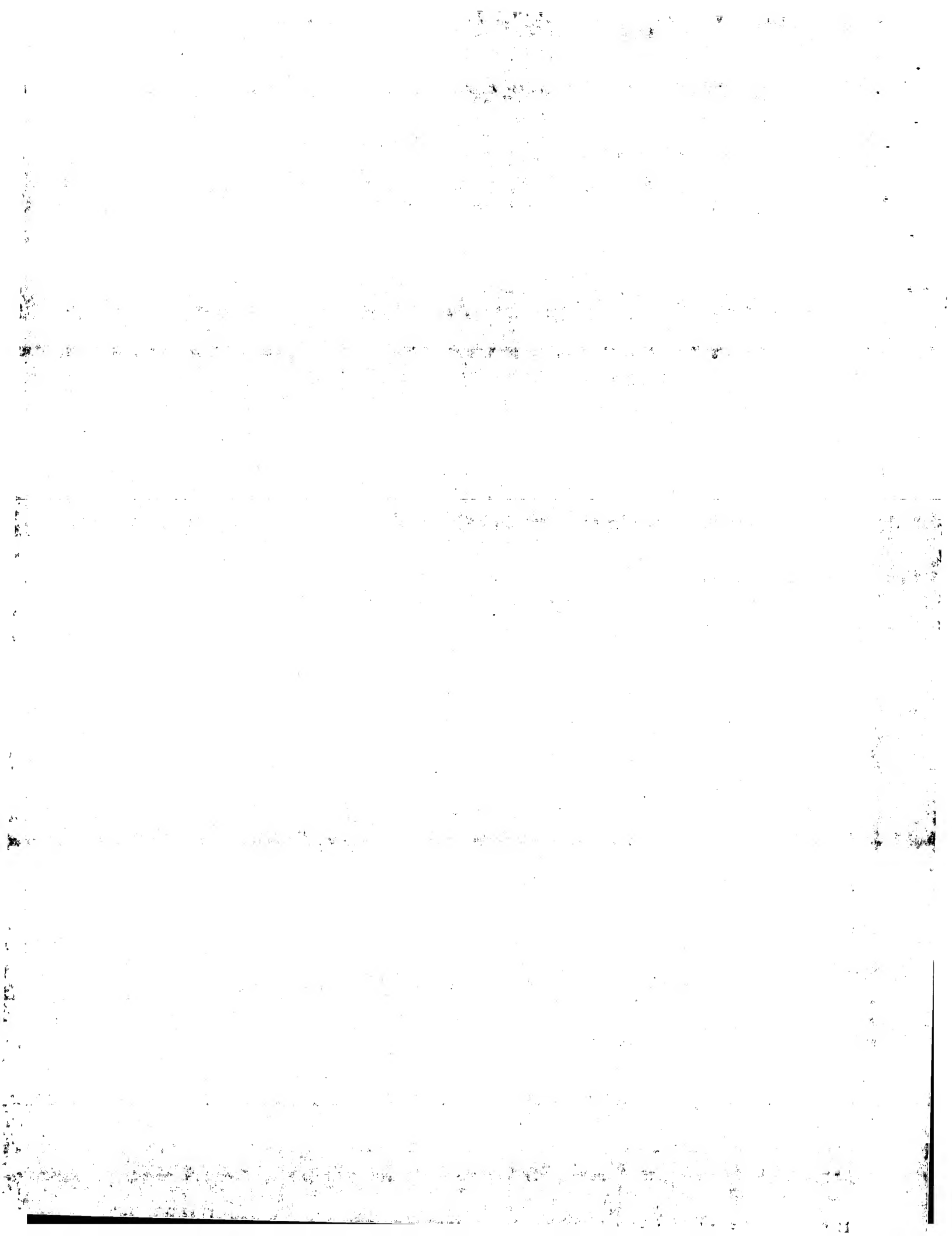
It is preferred to use meshes that are flexible, and for this reason it is preferred to use relatively thin mats having a maximum thickness of the order of about 0.5 mm to 1 mm (e.g. up to 0.2 mm) and to use meshes made of relatively thin fibres, e.g. having a fibre diameter of no more than 1 mm in particular no more than .2 mm (i.e. 200 microns).

A reinforcing mesh whether for the broad faces or for the longitudinal marginal edges may be bonded to the core in any suitable fashion keeping in mind the reinforcing role that these meshes are to play. A reinforcing mesh may for example be bonded to a core by a cementitious slurry, for example, a portland cement slurry, or may be bonded by a cementitious component of a core mix extending through the openings in the mesh.

In accordance with the present invention a longitudinal edge face of a longitudinal marginal edge (i.e. a minor side face of a panel) need not be reinforced with or be covered with a reinforcing fabric. If, for example, a longitudinal edge margin is reinforced with a U-shaped reinforcement mesh component the bridge member thereof need not, if so desired, be adhered to the longitudinal edge face; on the other hand

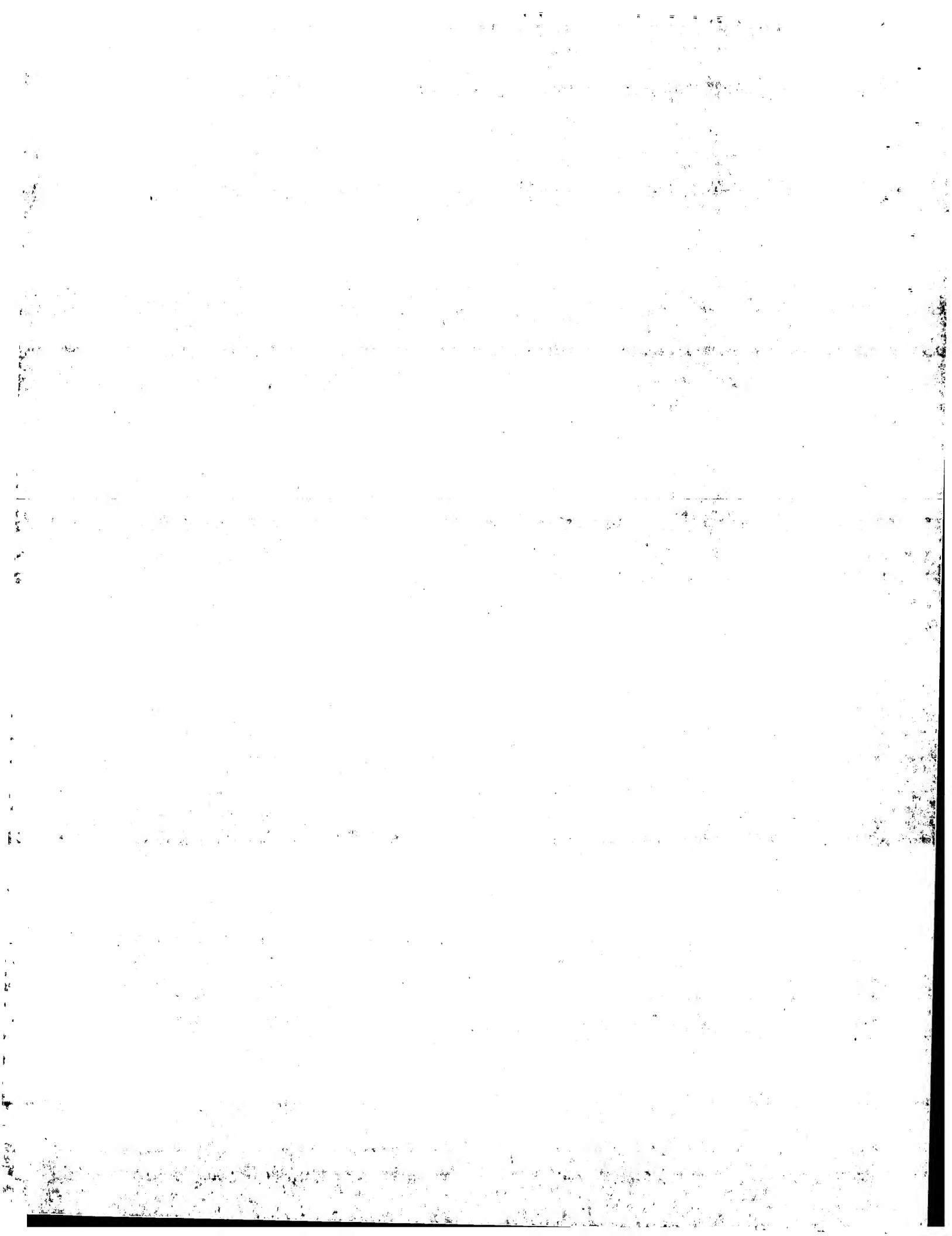


the bridge member may, if desired, be adhered to a longitudinal face as, for example, by an adhesive, by cementing or by being embedded in the core surface cement material. As may be appreciated from the above a bridge member links or connects a pair of arm members (i.e. edge strip members). These arm members are adhered to a marginal area of a respective broad face. However, such adherence need not be over the entire lateral width thereof. For example, a marginal area may comprise a grip region and an adhesion free region. The adhesion free region may border the longitudinal edge face. In this latter case an arm member may be adhered only to the grip region and not to the adhesion free region such that the cross section of the marginal edge may show that a U-shape surface including the surface of the longitudinal edge is not adhered to the U-shaped reinforcement mesh component, distal end portions only of the arm members are adhered to the marginal edge faces. Keeping in mind that the purpose of the U-shaped reinforcement mesh component is to reinforce the longitudinal edge of a panel the lateral width of a grip region is preferably larger (e.g. substantially larger) the lateral width of an adhesion free region bordering the longitudinal edge face.

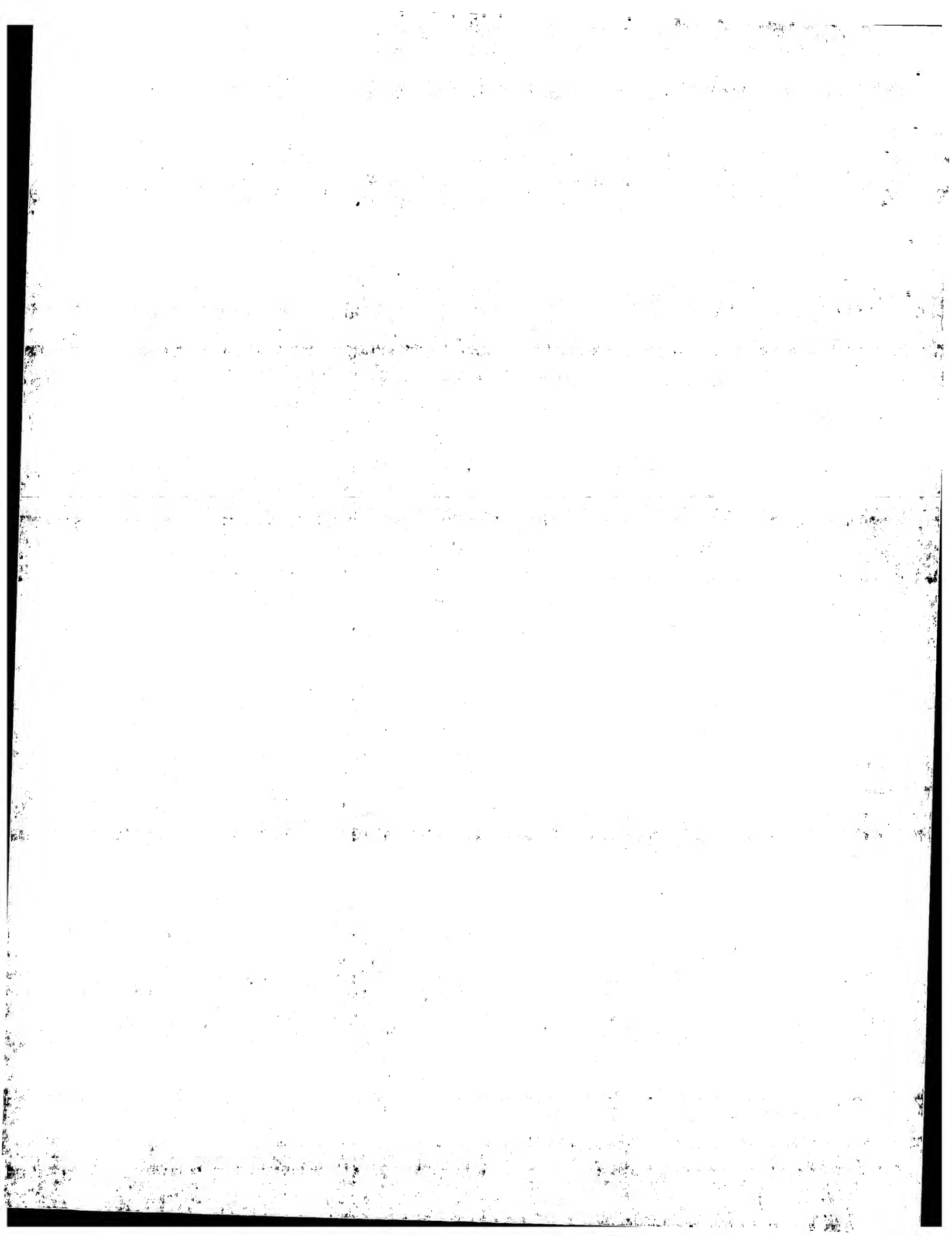


The reinforcing mesh of the major faces and a mesh disposed about a longitudinal marginal edge faces may, for example, be held in place in the set product by allowing a cementitious composition to infiltrate interstices of such a mesh such that at least some of the fibers of the mesh may be embedded in the hardened cementitious composition. In this case in order to facilitate such penetration of a mesh by the cementitious composition, the fabrics should comprise a sufficient or desired degree of voidage so as to allow the unhardened cement composition to penetrate the mesh. In other words, a reinforcing mesh adhered to a broad face of a core and at least the portion of an edge reinforcing mesh adhered to a core along a marginal area thereof may be pervious meshes (i.e. pervious to cementitious slurry); the openings in a mesh, scrim or other fabric in this case are to be sufficiently large to permit passage of the mesh bonding material such as a portland cement slurry, i.e. such that a mesh or scrim is cemented to or embedded in a face or surface.

In accordance with the present invention a cementitious panel may be produced employing a core mix alone or if desired by also employing a cementitious slurry.



By way of example only, a cementitious panel in accordance with the present invention, may be obtained by following the immediately herein below described steps. A first web of reinforcing mesh may first be provided for a core face which during manufacture forms part of the bottom layer of the panel and which is not as wide as the panel width. A marginal section or area of the first web on each side of the centre may be disposed to overlap a portion of an edge reinforcing web or mesh of fabric leaving outer edge portions thereof uncovered thereby; the uncovered portion may be folded over to wrap each of the two edges of the core layer and also to extend over on to the top face of the core layer and overlap the upper broad face reinforcement mesh. A cementitious slurry may first be applied onto the first web so as to embed it therein and may be applied so as to leave uncovered at least an outer portion of the edge reinforcing webs for covering the longitudinally edge faces. The centre section of the first web receives the core layer after the application of the slurry if used and it also may be laid down so as to leave exposed outer marginal portions of the web or mesh to be wrapped about the longitudinal edges. A second web of reinforcing fabric (which forms the top layer of the panel) which is of the same width as the first web may be laid down

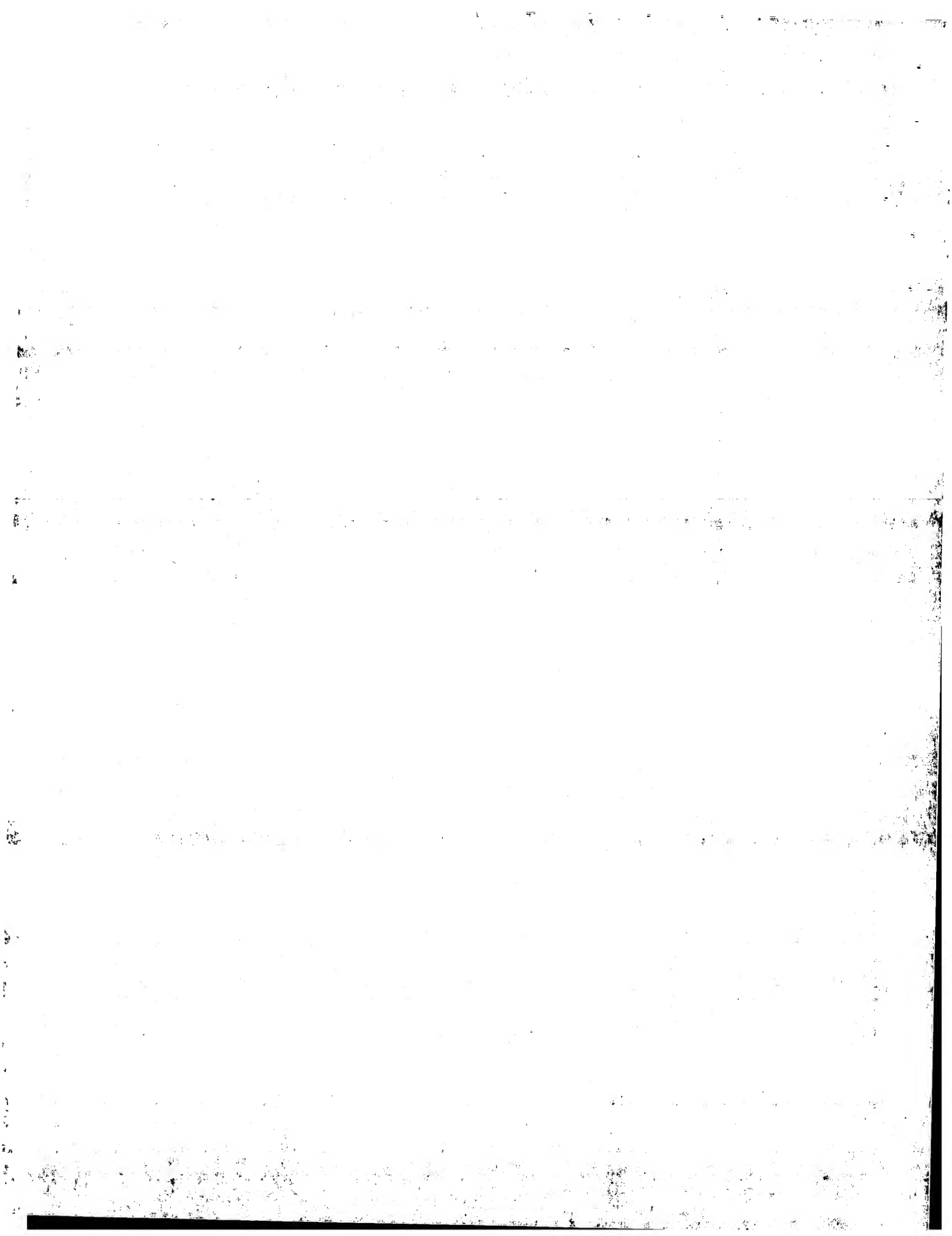


on top of the core layer so as to overlay it and as desired or necessary is pushed just under the upper surface of the core so as to be embedded in the top surface. Bonding material such as a portland cement slurry may also as desired or necessary is applied to the second web either before or after
5 it is laid down on the core layer.

A core mix may for example comprise water, a cementitious material (i.e. a hydraulic cement which is able to set on hydration such as for example, portland cement, magnesia
10 cement, alumina cement, gypsum, and the like or a blend thereof) and an aggregate component selected from among mineral and/or non-mineral (e.g. organic) aggregate(s). The ratio of mineral aggregate to hydraulic cement may be in ratio of 1:6 to 6:1. The ratio of non-mineral aggregate to
15 hydraulic cement may be in ratio of 1:100 to 6:1.

The particle size distribution of the aggregate may vary over a wide range e.g. up to about $1/3$ (e.g. up $1/4$) of the thickness of the panel or smaller, such as for example from
20 $1/32$ of an inch to $1/4$ of an inch.

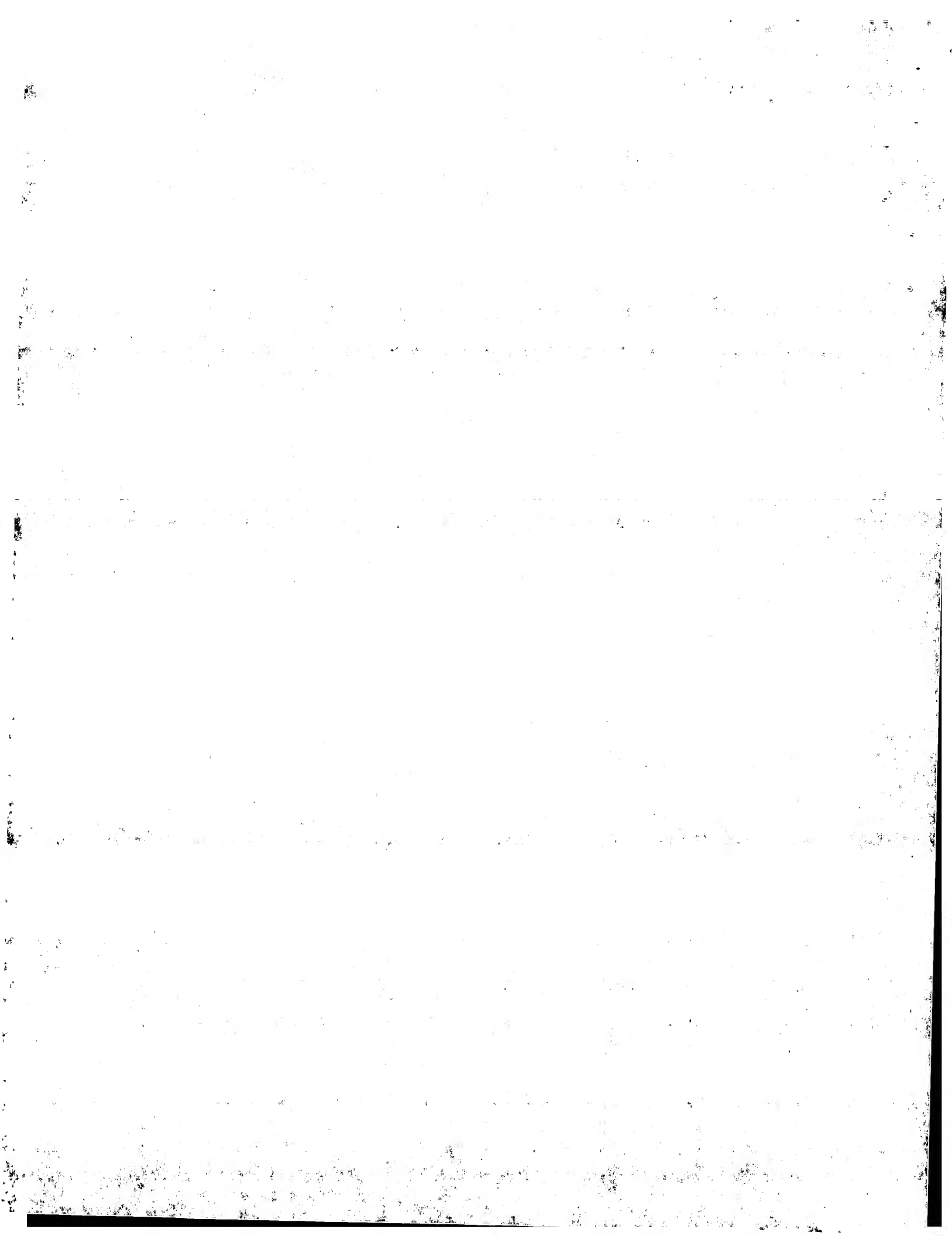
The core mix may in particular be composed so as to comprise a



lightweight mineral and/or non-mineral (e.g. organic) aggregate(s) (e.g. sand, expanded clay, expanded shale, expanded perlite, expanded vermiculite, expanded closed-cell glass beads, closed-cell polystyrene beads and/or the like). Suitable lightweight aggregates, may for example in particular
5 be cellular in nature; a suitable non-mineral lightweight aggregate is for example expanded closed-cell polystyrene beads.

Aggregate for use in the cementitious core mix composition may
10 be selected in accordance with the desired density of the finished panel. Aggregate may, for example, have a density of up to 120 pounds per cubic foot. For example, lightweight aggregates such as obtained from expanded forms of slag, clay, shale, slate, perlite, vermiculite and the like may produce
15 panels having a density of from about 80 to about 115 pounds per cubic foot. On the other hand a material such as closed-cell glass beads or a plastic such as polystyrene beads may be used to obtain a panel having a density of from about 40 to 70 pounds per cubic foot or lower.

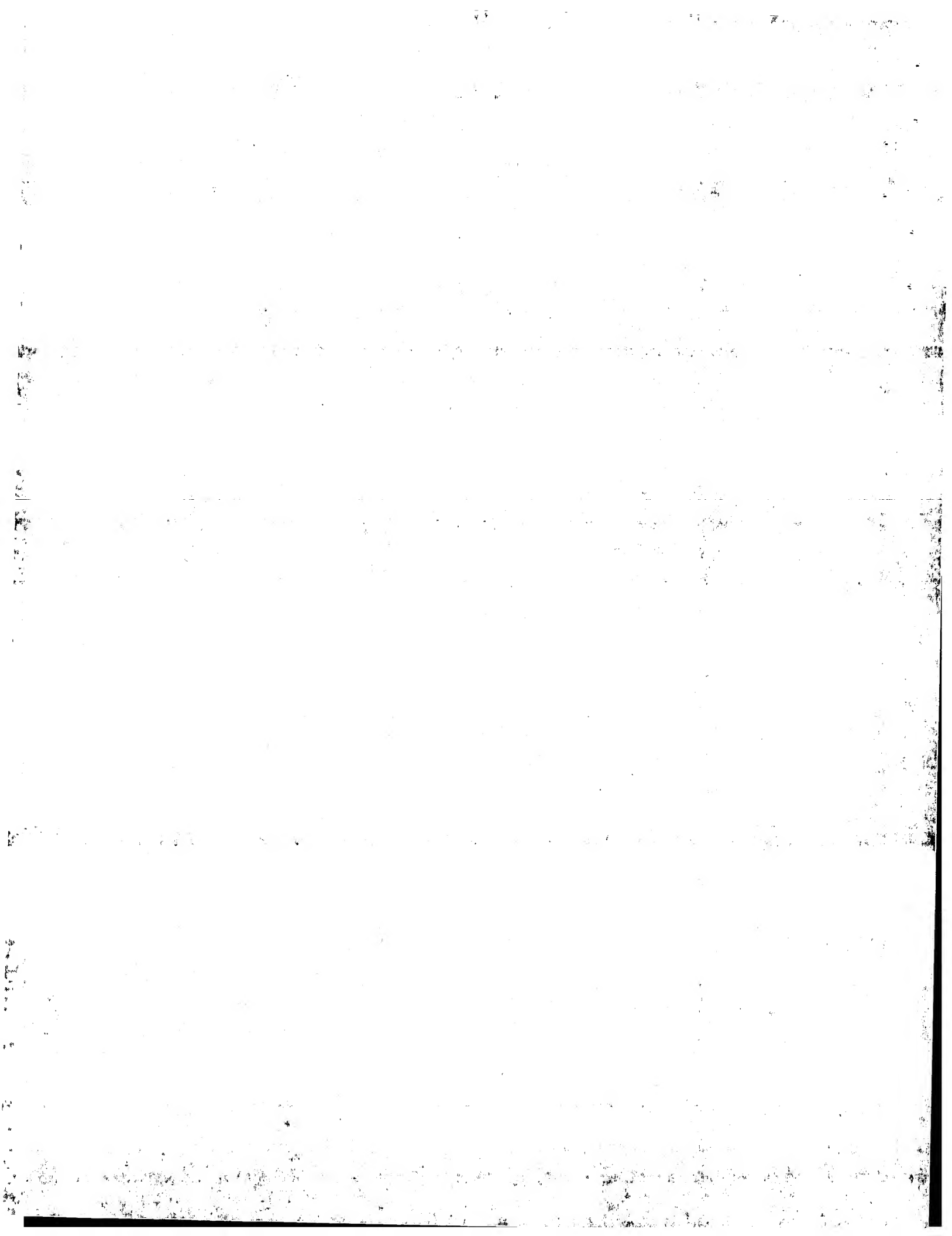
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A cementitious slurry may for example comprise water and a cementitious material (i.e. a hydraulic cement as described



above). A cementitious slurry, such as a portland cement slurry, is strongly basic or alkaline having a pH of at least 11, due to the presence of calcium hydroxide, e.g. a pH of from 11 to 14, such as a pH of 11 to 13, e.g. a pH of 12.5 to 13. Such a slurry tends to react with, or have an affinity for, base-reactive surfaces and consequently have a decided tendency to cling to these surfaces.

As mentioned above a reinforcing mesh is adhered to the face of a panel. It is possible in accordance with the present invention for example to embed a mesh in a broad or narrow face of the core such that the mesh is disposed at or near the surface of the board so as to enhance the strength of the board or panel, i.e. the strength of the panel is enhanced if a mesh is adhered at a core face. The embedment of the reinforcing fibers just beneath the surfaces of the core may for example be carried out at a depth of submersion of mesh from for example about 0.5 mm to about 2.0 mm or less, e.g. 0.5 mm or less.

The core mix may be applied in any desired thickness, for example of values so as to be able to obtain a panel having the standard thicknesses of plasterboard. A panel may be

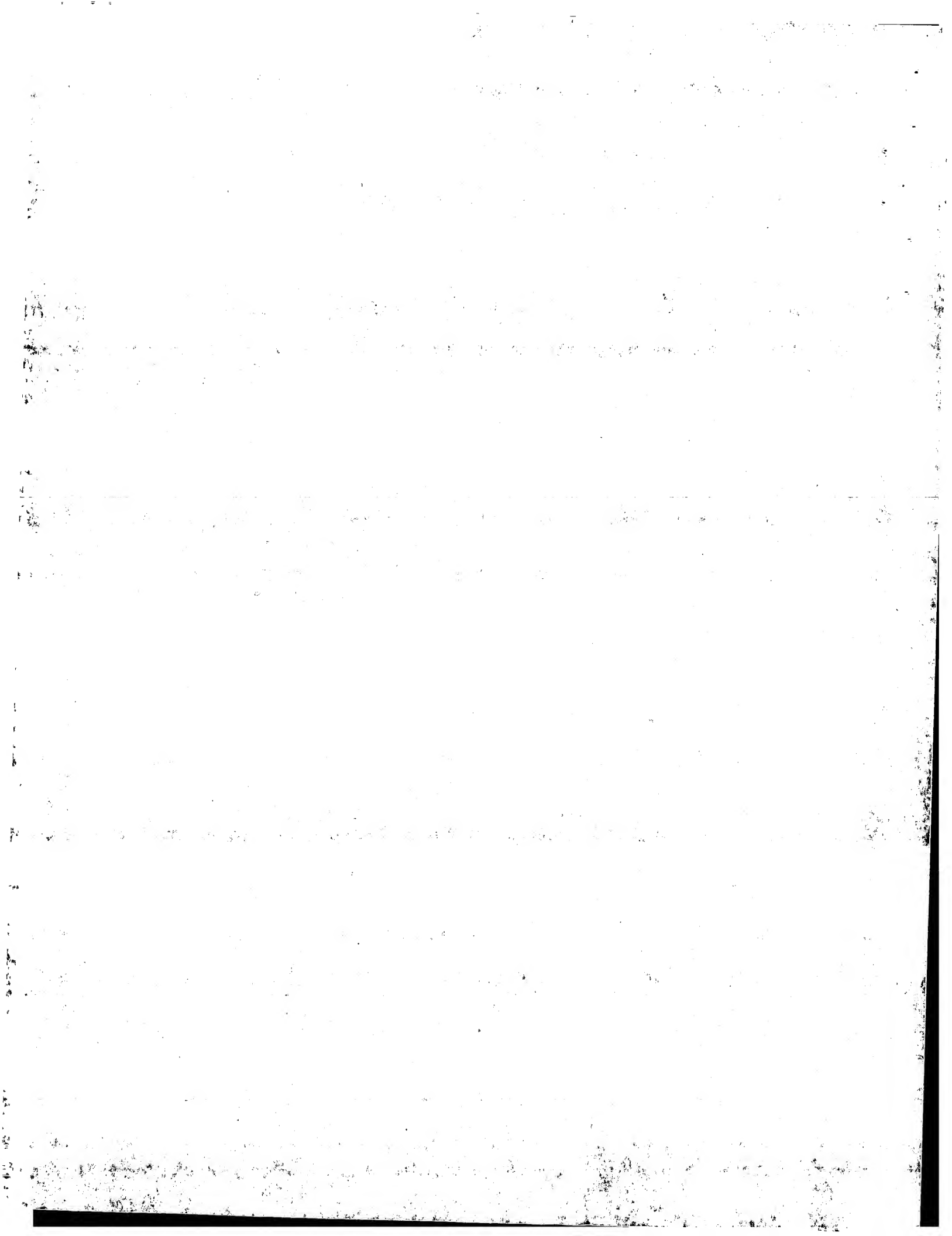


produced in varying thickness depending upon end use: e.g. in thicknesses of 1/4", 3/8", 1/2", 5/8", 3/4", 1" etc.

In accordance with the present invention a cementitious core mix composition may be used which when cured has cells present due to entrained or entrapped air. Accordingly a core mix may, for example include or comprise a suitable air entrainment or foaming agent in such amounts so as to produce the desired or necessary degree of air entrainment.

As mentioned above the initial side edge meshes and first broad face mesh are laid down on a suitable carrier support web; the carrier support web may for example advantageously be of a non-stick material relative to the cementitious material, i.e. the carrier on which the board is formed may be of a material to which the cementitious slurry does not readily adhere, example material are polyethylene or polypropylene film, 1.0 to 5.0 mils thick: polyethylene coated Kraft paper, 30 lbs to 100 lbs of strength.

As mentioned above however it may be desired to provide an edge face mesh which is not adhered to the edge face so as to avoid having the cementitious composition covering up a

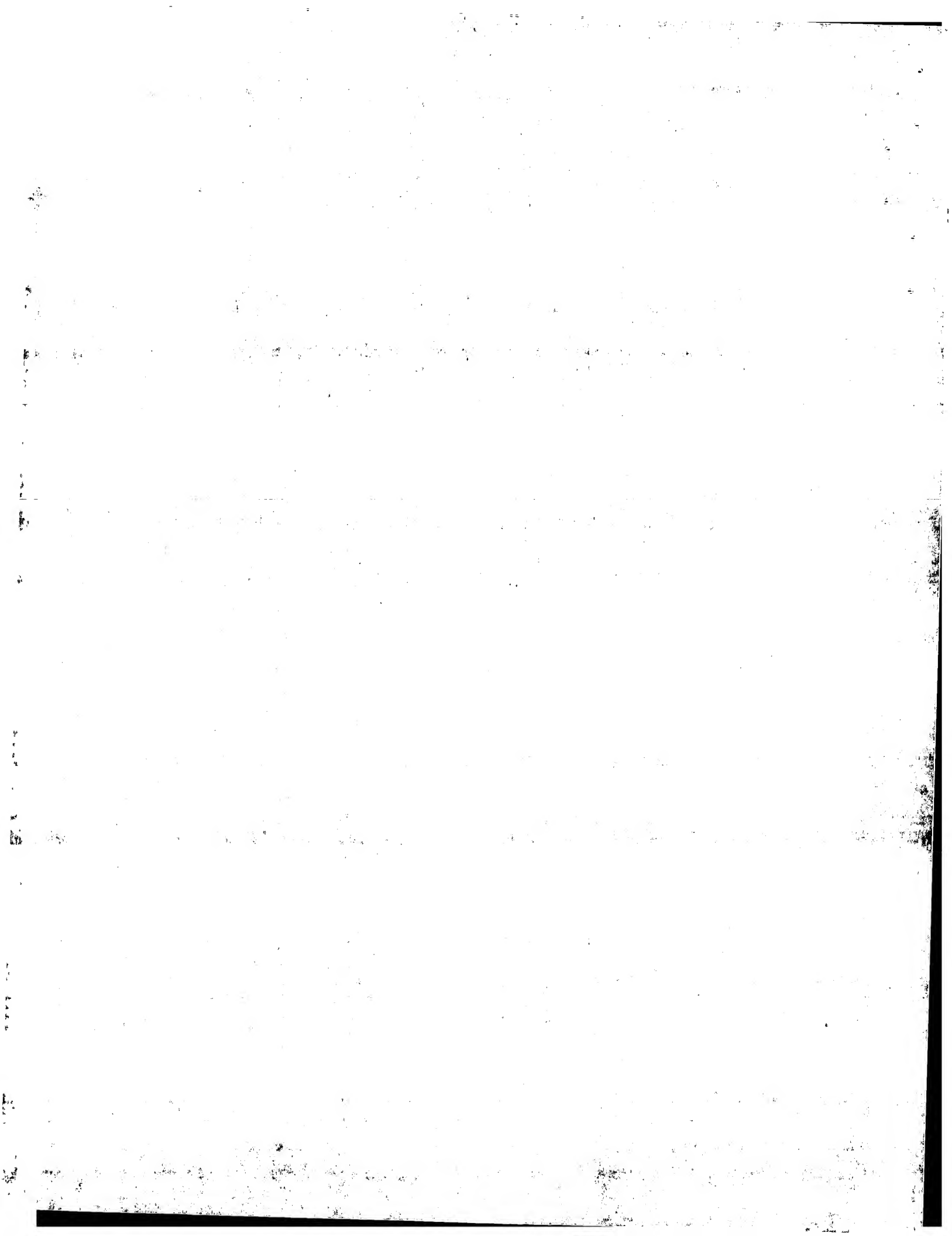


desired indica which is to appear on the side edge of a panel. This may be achieved for example by providing the above mentioned edge reinforcing web with an at least substantially water impervious outer surface opposite the edge face or with a fibre or filament structure which may filter out any solids
5 at the surface thereof so as to inhibit a mechanical bond on setting of the cementitious material.

The edges reinforcements may, for example extend inwardly from a longitudinal edge face approximately 0.5" to 2.5".

10

As mentioned above polystyrene may be used as lightweight aggregate. Polystyrene should be expanded following
15 manufacturers instruction. Bin and equipment must be of the sufficient size to comply with the production rate and the time/recipe requirements. Polystyrene preferably is expanded to the desired density with a tolerance of 0.1 lb. per cubic foot. Anti-static liquid dispensing equipment may be provided
20 for a free flow of material into measuring bins. Rotary valves will permit the incorporation of the necessary quantity in the core mixer, e.g. to the nearest 0.01 Kg.



As mentioned other agents may be added to the cementitious material for example, an air entraining agent. Air entraining agent works like a soap except it is able to create very small air bubbles that are visible only with a microscope. The air entraining agent is not necessarily used to make the board lighter. A given amount of a specific type of air entraining agent may be chosen to create air bubbles which will inhibit damage that can be caused by freezing and thawing cycles. The bubbles may be so small that water does not have a tendency to penetrate them, so the water absorption of the board is not affected.

A panel in accordance with the present invention may thus comprise relatively thin surface reinforcement elements on the faces thereof so as to provide the panel with a relatively high strength. The panel may also have a core which is relatively readily penetrable by nails, screws and other fasteners. A panel may be obtained wherein the surface edge reinforcement layers are relatively strong and hard such that a nail or screw may be driven through the edge of panel

without pre-drilling and without breaking, even when nailed or screwed almost at the very limit of the edge of the panel.

In drawing which illustrate example embodiments of the present invention,

5

Figures 1 to 4 illustrate in schematic cross sectional views steps in the formation of an example panel in accordance with the present invention;

Figure 5 is a schematic partial cross sectional view of a reinforced edge of a panel made in accordance with the steps illustrated in figures 1 to 4;

10

Figure 6 is a schematic partial cross sectional view of a reinforced edge of another example panel made in accordance with the present invention wherein only one broad side face includes reinforcing mesh at the marginal edge area thereof

15

Figures 7 to 11 illustrate in schematic cross sectional views steps in the formation of another example panel in accordance with the present invention having a U-shaped edge reinforcing mesh;

20

Figure 12 is a schematic partial cross sectional view of a reinforced edge of a panel made in accordance with

the steps illustrated in figures 7 to 11;

Figures 13 and 13a each illustrate in schematic partial cross sectional view a step in the formation of additional example panels in accordance with the present invention wherein the bridging member is not adhered to the core;

Figure 14 and 14a are each schematic partial cross sectional views of a reinforced edge of a panel made in accordance with a process respectively including the step illustrated in figures 14 and 14a;

Figure 15 is a schematic partial cross sectional view of the edge of another example panel in accordance with the present invention;

Figure 16 is a schematic partial cross sectional view of the edge of a further example panel in accordance with the present invention;

Figure 17 is a schematic partial cross sectional view of the edge of yet another example panel in accordance with the present invention;

Figure 18 is a partial schematic perspective view of the forward end of an apparatus in accordance with the present invention for making an edge reinforced panel in accordance with the present invention;

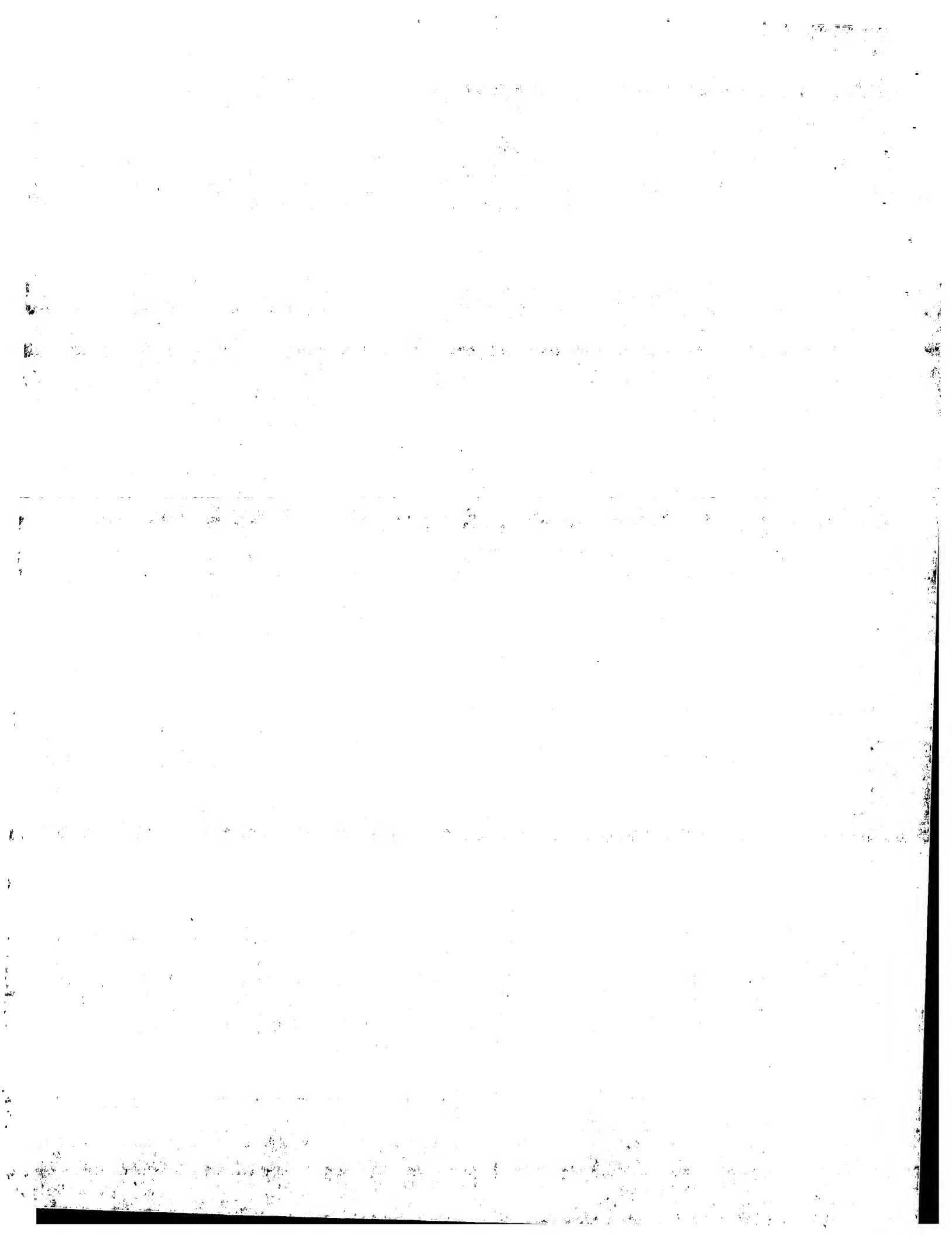


Figure 19 is a partial schematic perspective view of the central part of the example apparatus for which the forward end is shown in figure 18;

Figure 19a is a schematic enlarged side view of the crank system

5 for a support member of the first mesh layer alignment component shown in figure 19 and which includes dual crank components;

Figure 19b is a schematic enlarged top view of the crank system

10 shown in figure 19a;

Figure 19c is a schematic enlarged end view of the crank system

shown in figure 19a;

Figure 20 is a partial schematic perspective view of the rear end of the example apparatus for which the forward end is shown in figure 18;

Figure 21 is a partial schematic perspective view of the forward end of an apparatus in accordance with the present invention for making an edge reinforced panel in accordance with the present invention wherein the bridging member is not adhered to the core;

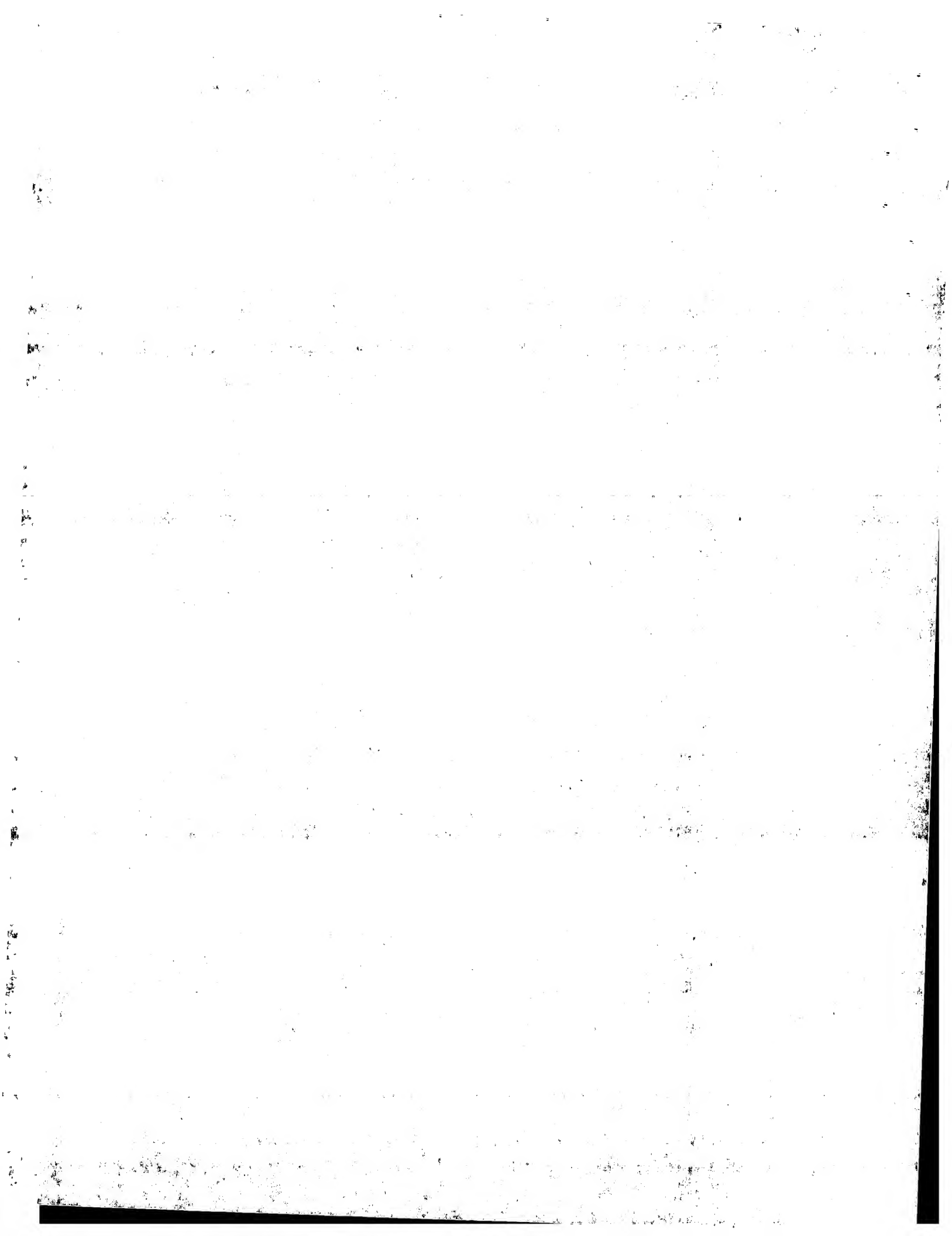
Figure 22 is a partial schematic perspective view of an example strip feeding mechanism for feeding reinforcing strips to the forward end illustrated in figure 18;

Figure 23 illustrates in schematic perspective view an edge strength test for a panel section having an edge reinforcement in accordance with the present invention and a panel section having a known wrap around reinforced edge as illustrated in U.S. patent no. 5,221,386 the entire contents of which are incorporated herein by reference (see figure 6 of this patent).

The invention will hereinafter be described in more detail in relation to the drawings by way of example only, in terms of a panel (e.g. wallboard) having a cementitious core comprising a hydraulic cement and aggregate of a lightweight type. The drawings are schematic in nature, are not drawn to scale and in some cases elements are exaggerated for purpose of illustration only.

Figures 1 to 4 illustrate in a series of cross-sectional views a sequence of steps in a method for the manufacture of an

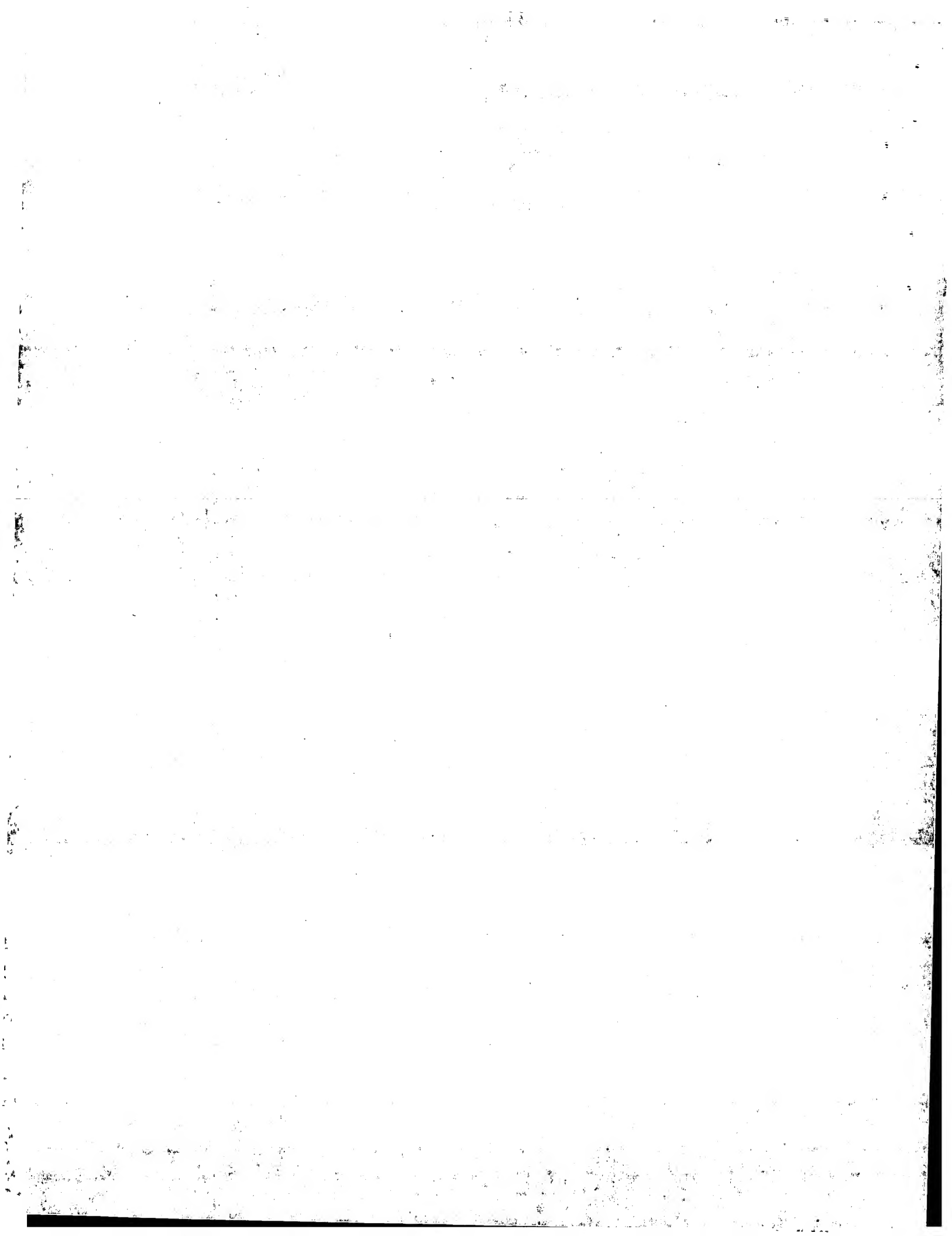




example edge reinforced panel in accordance with the present invention wherein the longitudinal edge faces are not closed off. In these figures the reference numeral 1 indicate a conveyor belt, i.e. a support member and the reference numeral 2 indicates a protective film which is supported and advanced by the conveyor belt 1. The protective film 2 is wider than the panel to be made.

In figure 1 a web of a first non-woven oriented glass mesh 3 is shown with a previously applied portland cement slurry 4 deposited thereon across its breadth in a layer. The first non-woven oriented glass mesh 3 has also previously been laid on the protective film 2 such that it overlaps a pair of first bands 5 and 6 of polypropylene non-oriented mesh which were previously laid on the protective film 2 in parallel spaced apart relationship, the first bands 5 and 6 being disposed along margin sections 7 and 8. As may be seen the margin sections 7 and 8 are covered by the first non-woven oriented glass mesh 3 and by the slurry 4 such that both the first non-woven oriented glass mesh 3 and the first bands 5 and 6 are slurried.

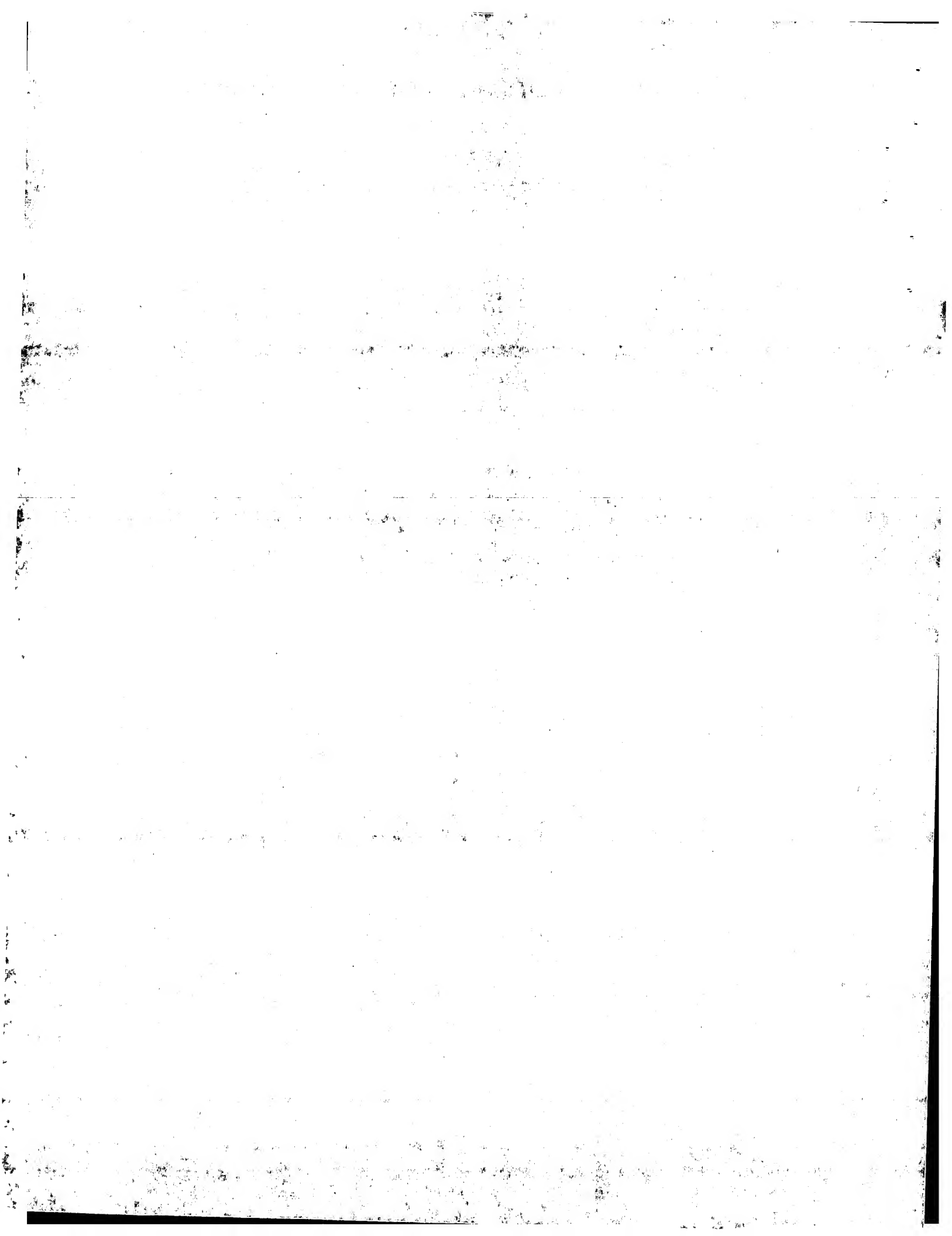
In figure 2 a core mix 10 is shown as having been laid upon



the slurried first non-woven oriented glass mesh 4 so as to be deposited across the breadth thereof in a layer.

In figure 3 a second non-woven oriented glass mesh 12 is shown as having been laid upon the upper surface of the core mix 10 across the breadth thereof. This second non-woven oriented glass mesh was laid down under the urging or influence of a vibrating urging means which urged the second non-woven oriented glass mesh 12 into the upper surface of the core mix, i.e. so as to embed the second non-woven oriented glass mesh 12 in the top surface of the core mix 10.

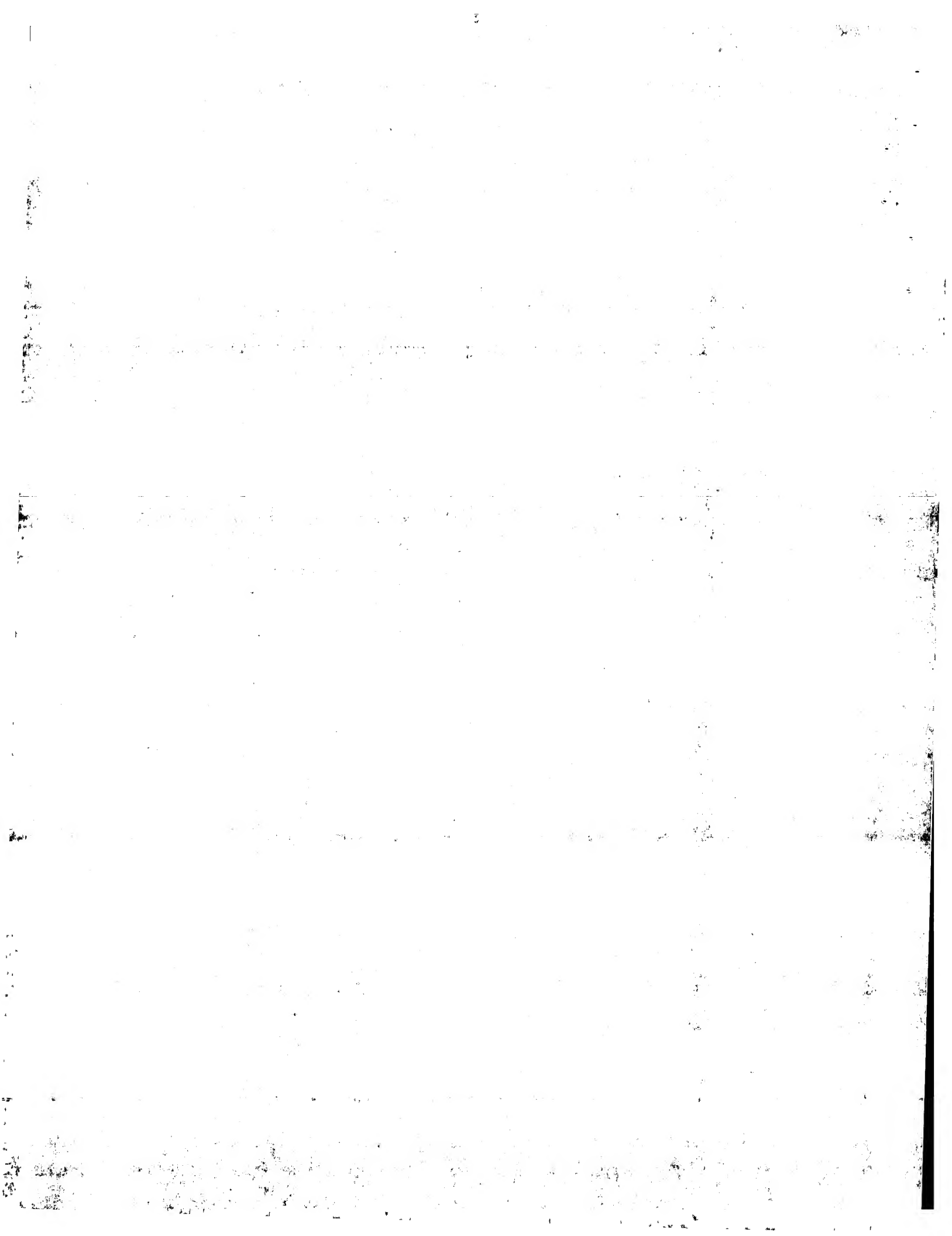
In figure 3 an additional pair of second bands of polypropylene non-oriented mesh 14 and 15 are also shown in the process of being laid upon the second non-woven oriented glass mesh 12 in respective margin sections 7 and 8 opposite the previously laid down first bands 5 and 6. These second bands 14 and 15 are likewise laid down under the urging or influence of the vibrating urging means which urges these bands into the upper surface of the core mix on top of the second non-woven oriented glass mesh 12. The bottom of the core mix 10 is bonded to the mesh 3 by the slurry 4.



In this manner an edge reinforced panel is formed as shown in figure 4. The edge reinforced panel has a pair of opposed longitudinal edge faces 19 and 20. Each of the marginal sections 7 and 8 has a pair marginal areas namely areas 22 and 23 and 24 and 25 which are associated with respective broad
5 faces of the panel.

Figure 5 shows a schematic partial cross sectional view of a reinforced edge of a panel made in accordance with the steps illustrated in figures 1 to 4. It shows for example the
10 longitudinal edge face 20 as not being closed off by for example a mesh bridging member connecting respective first and second bands as shall be discussed with respect to the figures 7 to 12. In this case as may be appreciated the longitudinal edge faces of the core are exposed. As may be appreciated
15 from figure 5 a longitudinal edge face 20 and a respective pair of marginal areas 24 and 25 defines a longitudinal marginal edge; similarly for the other opposed side of the panel.

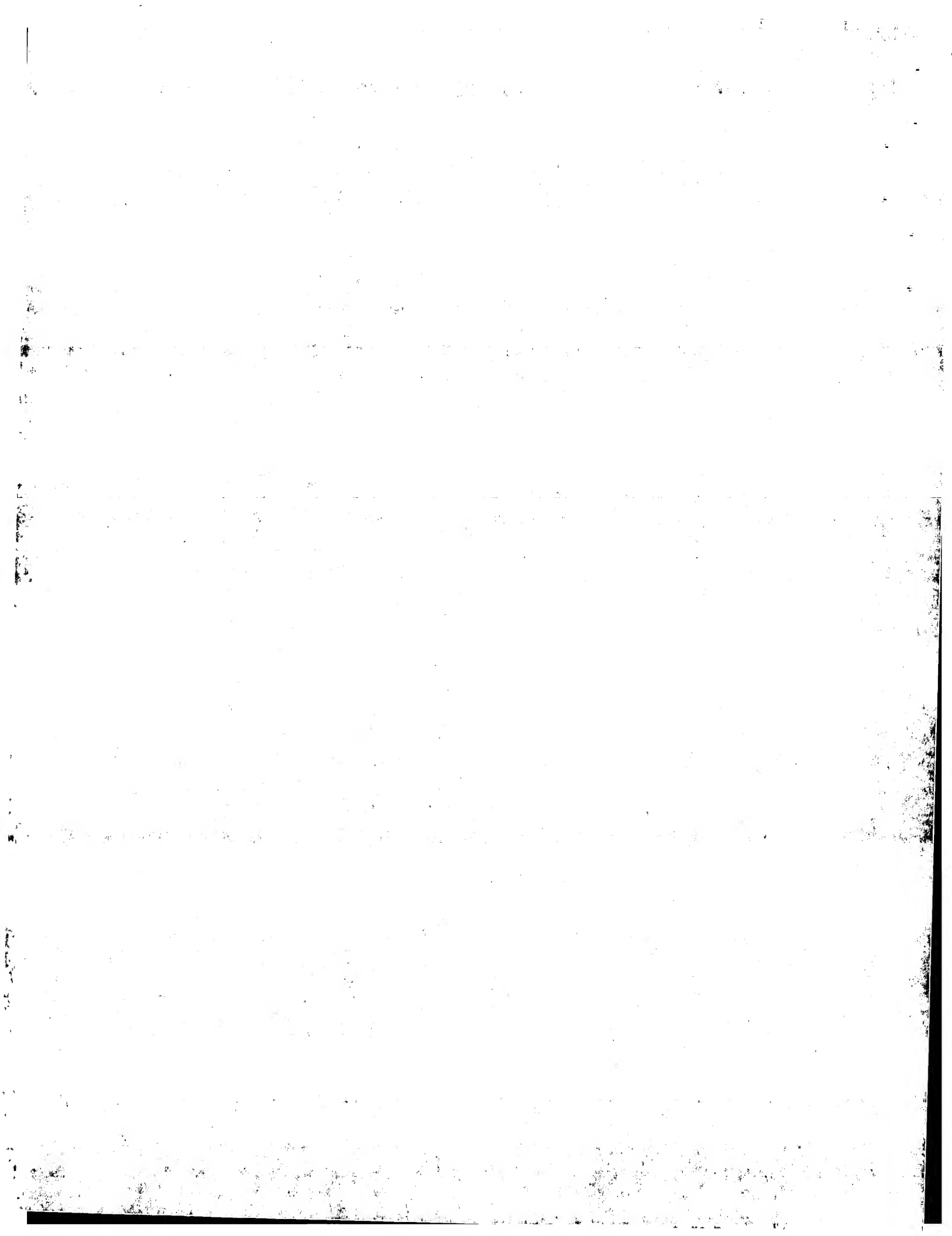
20 Figure 6 shows a schematic partial cross sectional view of a reinforced edge of a further panel made in accordance with the steps illustrated in figures 1 to 4 except that the first



bands have been omitted from the procedure such that the panel only has edge reinforcements due to the second bands; accordingly the same reference numerals have been used to designate common elements. It too shows the longitudinal edge face 20 as not being closed off by for example a mesh bridging member such that the longitudinal edge faces of the core are exposed.

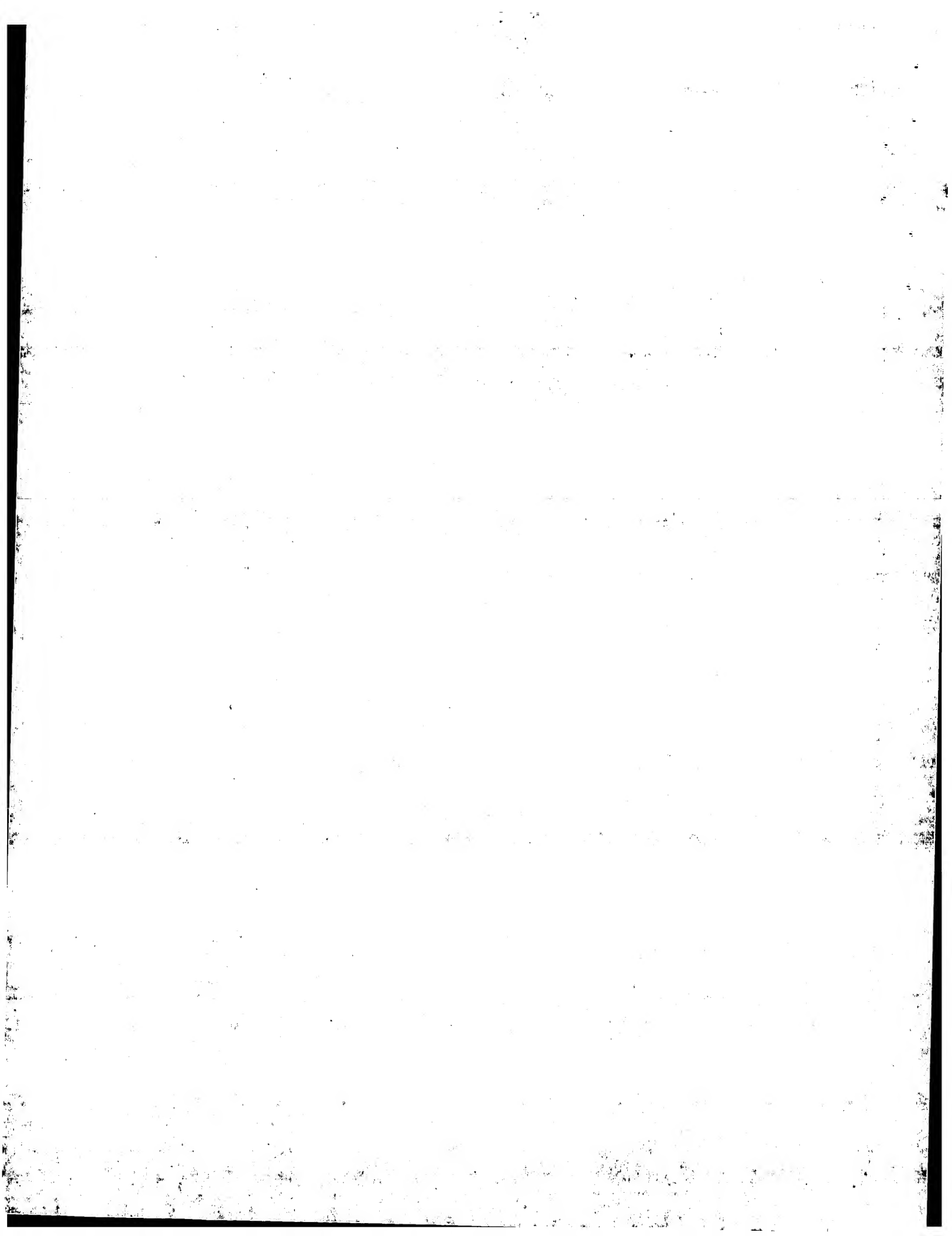
Figures 7 to 11 illustrate in a series of cross-sectional views a sequence of steps in a method for the manufacture of another example edge reinforced panel in accordance with the present invention wherein the longitudinal edge faces are closed off. In these figures the same reference numerals are used to designate elements common with those shown in figures 1 to 6.

In figure 7 a web of a first non-woven oriented glass mesh 3 is shown with a previously applied portland cement slurry 4 deposited thereon across its breadth in a layer. The first non-woven oriented glass mesh 3 has also previously been laid on the protective film 2 such that it overlaps a pair of wide bands 5a and 6a of polypropylene non-oriented mesh which were previously laid on the protective film 2 in parallel spaced



apart relationship. The wide bands 5a and 6a are disposed along margin sections 7a and 8a and are only partially covered by the first non-woven oriented glass mesh 3. As may be seen the margin sections 7a and 8a are only partially covered by the first non-woven oriented glass mesh 3 and by the slurry 4 such that while the first non-woven oriented glass mesh 3 is totally slurried, the wide bands 5a and 6a are only partially slurried, i.e. outer portions 30 and 31 of the bands 5a and 6a are left unslurried. On the other hand, if so desired the slurry may be disposed so as not to cover at all the wide bands 5a and 6a.

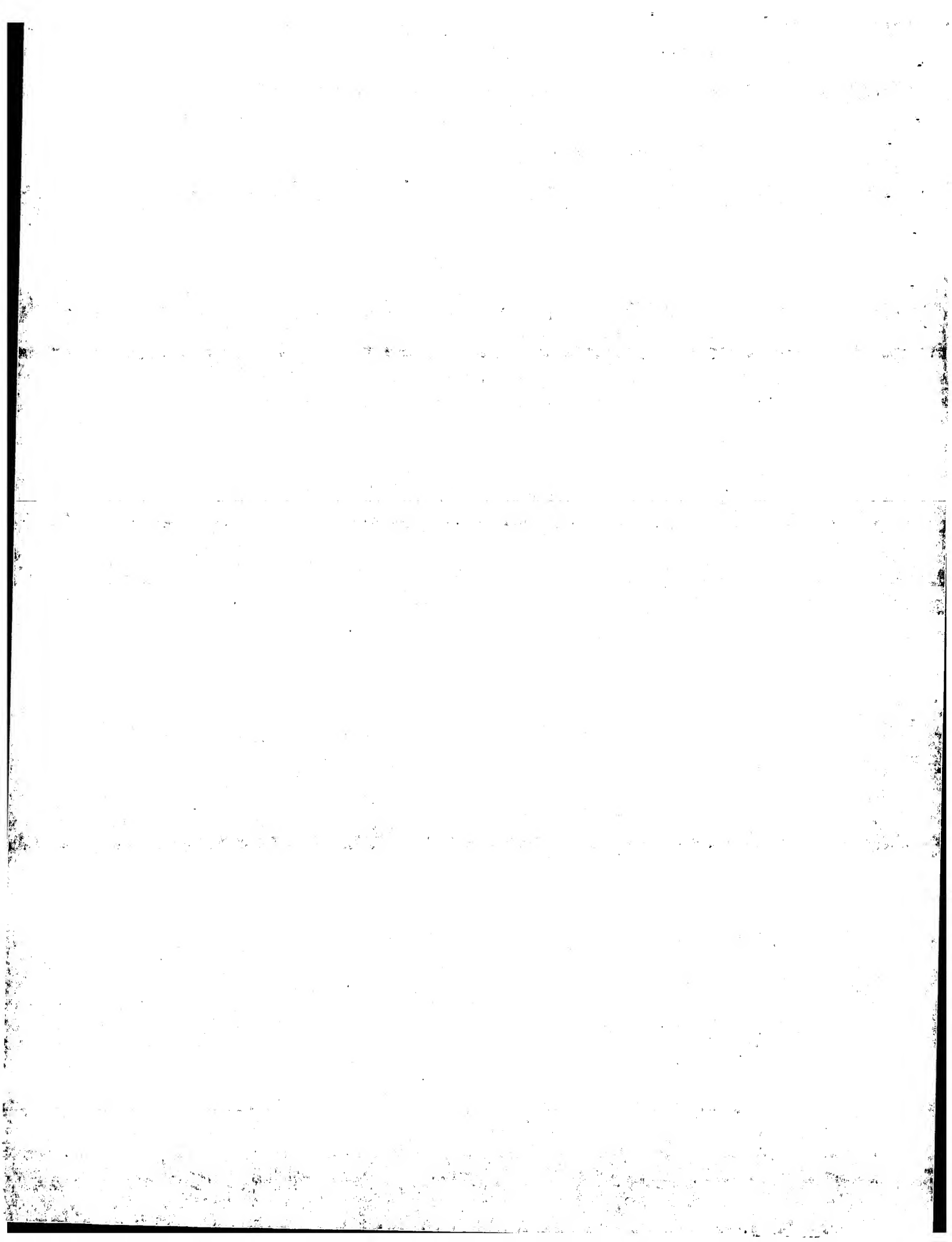
In figure 8 a core mix 10 is shown as having been laid upon the slurried first non-woven oriented glass mesh 4 so as to be deposited across the breadth thereof in a layer so as to again leave uncovered outer portions 30 and 31. Alternatively if so desired the slurry 4 may extend outwardly further over the wide bands 5a and 6a than the core mix 10 or vice versa. The slurry 4 may for example be extended outwardly further than the core mix in order to facilitate adherence (e.g. cementing) of the bands to the longitudinal edge face of the panel core or even the opposed broad face at a respective longitudinal marginal edge.



In figure 9 a second non-woven oriented glass mesh 12 is shown as having been laid upon the upper surface of the core mix 10 across the breadth thereof, again so as to leave uncovered outer portions 30 and 31. This second non-woven oriented glass mesh as before is laid down under the urging or
5 influence of a vibrating urging means so as to embed the second non-woven oriented glass mesh 12 in the top surface of the core mix 10.

In figure 10 the two outer portions 30 and 31 of the wide
10 bands 5a and 6a are folded upwards to an upright position by suitable guide means.

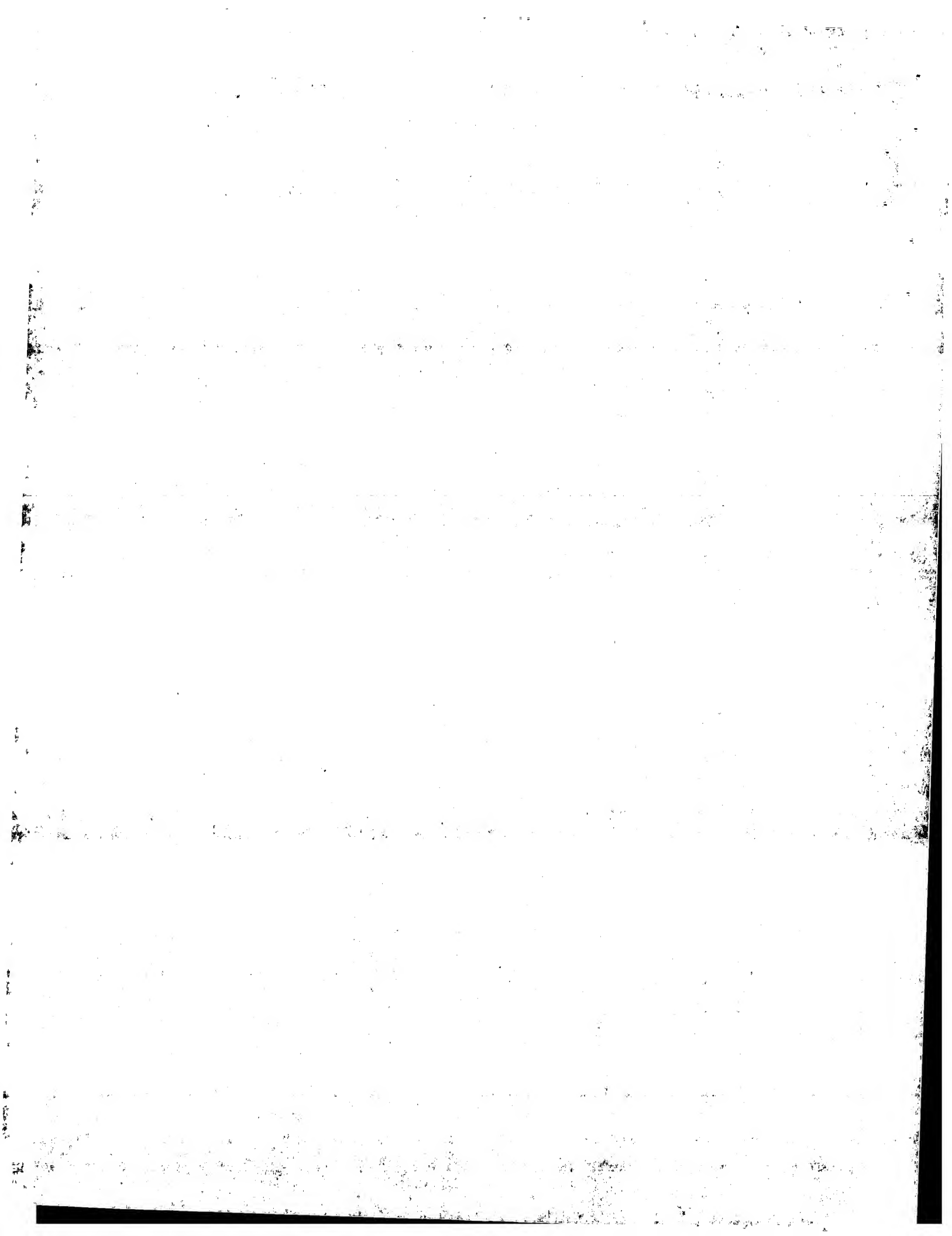
In figure 11 the outer portions 30 and 31 are bent or folded by suitable means over onto the second glass mesh 12 in
15 respective margin sections 7a and 8a so as to form respective U-shaped edge reinforcing meshes adhered to the first and second meshes 3 and 12. The bent over outer portions 30 and 31 are likewise laid down under the urging or influence of the vibrating urging means which urges the distal ends of thereof
20 into the upper surface of the core mix on top of the second non-woven oriented glass mesh 12.



In this manner an edge reinforced panel is formed as shown in figure 11. The edge reinforced panel has a pair of opposed longitudinal edge faces 19 and 20. Each of the marginal sections 7 and 8 has a pair marginal areas namely areas 22 and 23 and 24 and 25 which are associated with respective broad
5 faces of the panel.

Figure 12 shows a schematic partial cross sectional view of a reinforced edge of a panel made in accordance with the steps illustrated in figures 7 to 11. It shows for example the
10 longitudinal edge face 20 as being closed off by a mesh bridging member 36 of the U-shaped edge reinforcing mesh; this bridging member 36 connects respective first and second edge strip members 38 and 39. In this case as may be appreciated the bridging member may be adhered to the core mix due to
15 infiltration of cementitious material into or through the structure of the bridging member. Also as may be appreciated from figure 12 a longitudinal edge face 20 and a respective pair of marginal areas 24 and 25 defines a longitudinal marginal edge; similarly for the other opposed side of the
20 panel.

As mentioned above an edge reinforced panel in accordance with



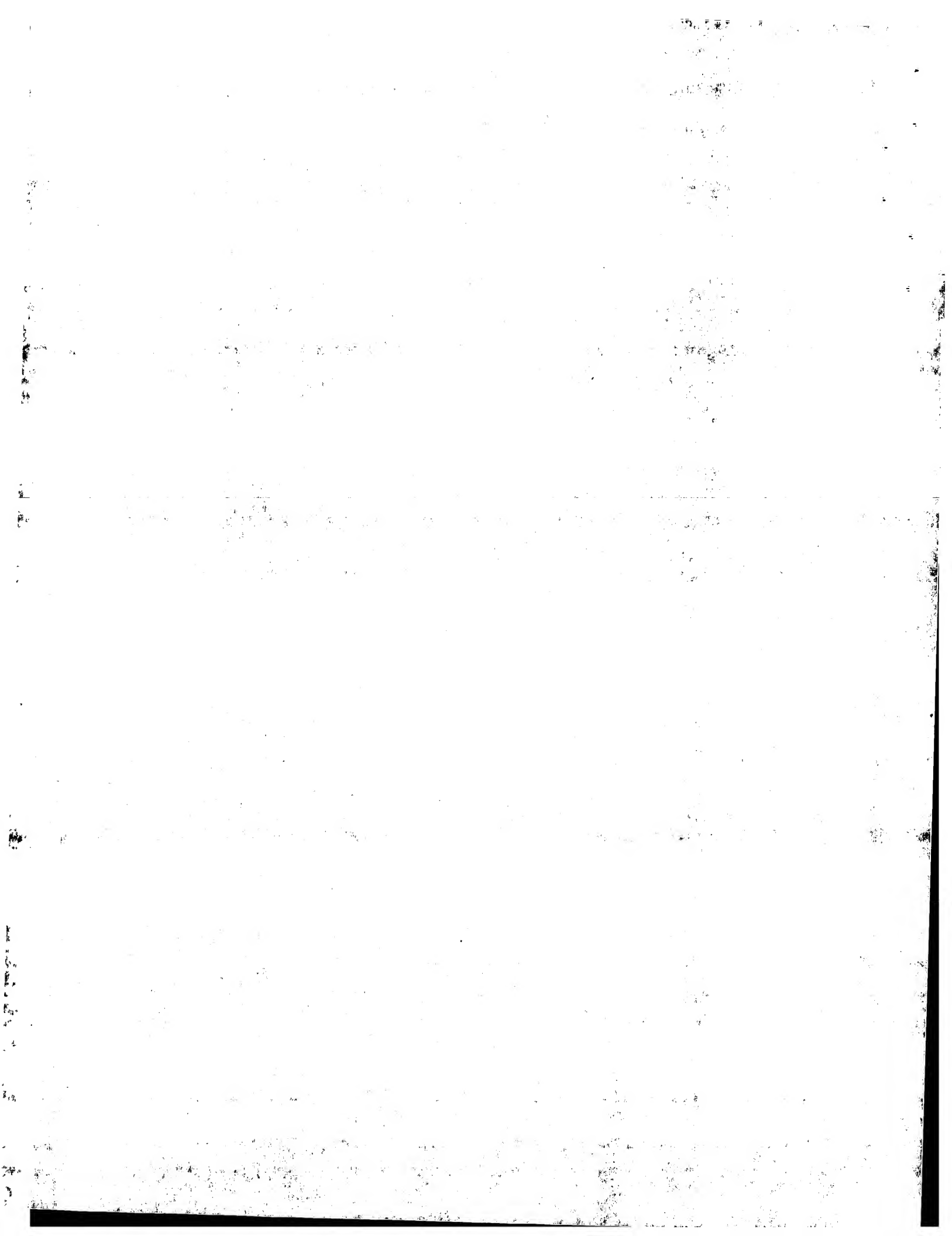
the present invention may comprise a U-shaped edge reinforcing mesh wherein a bridging member need not be adhered to a respective longitudinal edge face but may merely abut such face or as desired be spaced apart therefrom; in this case the bridging member may for example be provided with a water

5 impervious character such that cementitious material from the slurry of the core mix may not pass into or through the bridging member during the manufacture of a panel. It is possible for example to provide a wide band such as bands 5a and 6a with a centrally disposed at least substantially water

10 impervious longitudinally extending zone on the core side thereof. The zone may be provide by means of any mechanism which may render the central zone impervious, e.g. by applying a water tight tape, by applying a suitable paint, by applying a wax material etc, to the central zone. In such case it is

15 possible, for example, to apply to the opposite exposed side of the bridging member a desired indica in the form for example of a colour, words, etc.. Suitable materials are as follows: adhering tape: masking tape, translucent shipping tape, electric tape or other self adhering tap; size: 0.5 to 4

20 inches wide, preferably 1.5" wide; made preferably of: polyethylene, paper, but can also be made of other impervious or semi-impervious material.

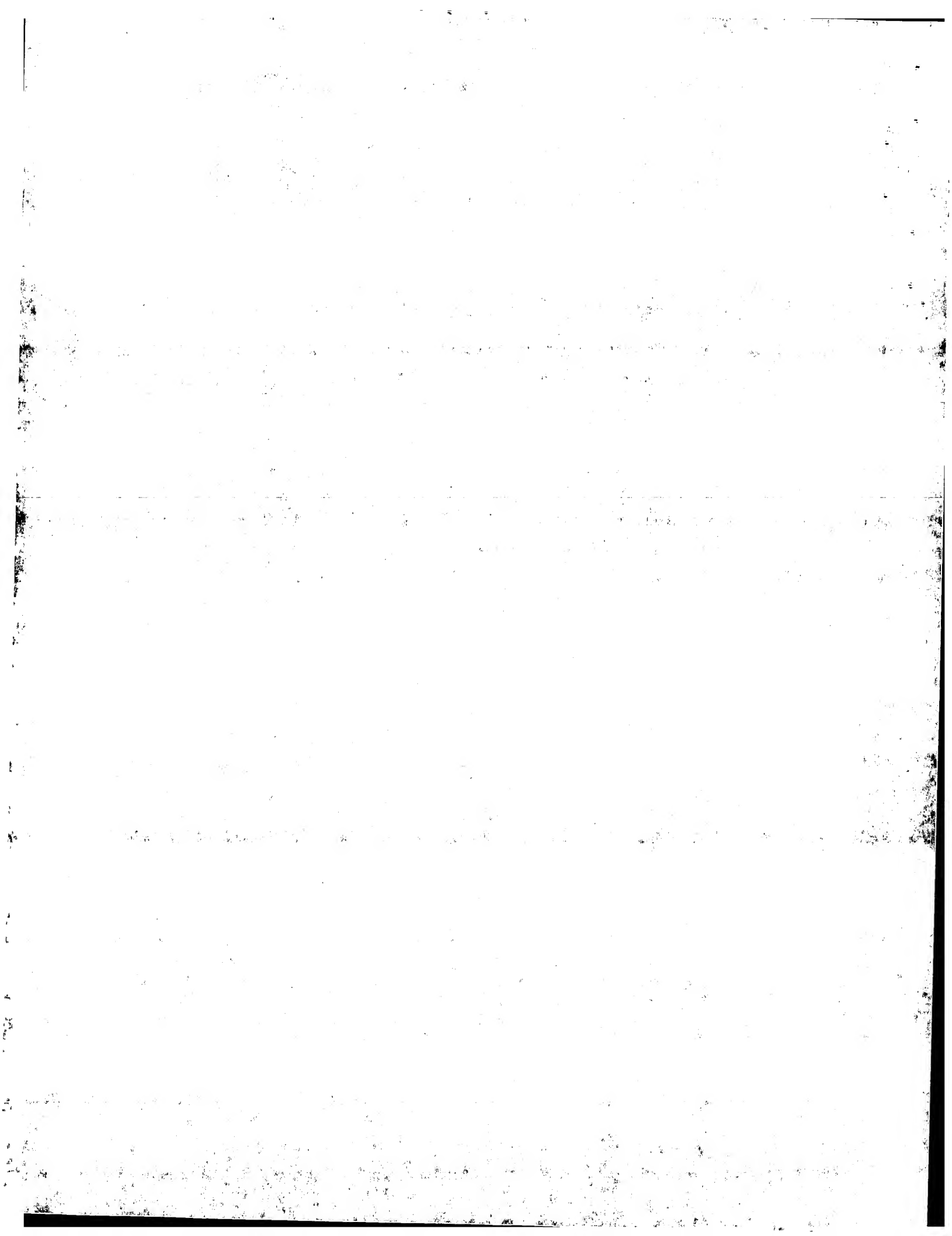


Material coatings: acrylic paint, oil paint, varnish, wax, silicone sealant, applied with roller or spray equipment on a width from 0.5 to 4 inches wide, 1 preferably 1.5" wide. The coating can be impervious or semi-impervious.

Material: non adhering film: 1 to 5 mils thick; 0.5 to 4 inches wide, preferably 1.5" wide; made preferably of: polypropylene, polyethylene, paper, but can also be made of other impervious or semi-impervious material.

Figure 13 shows a schematic partial cross sectional view similar to figure 7 but wherein the wide band 6a is provided with a central longitudinally extending, at least substantially water pervious zone defined by an at least substantially water proof tape 40 which is attached (e.g. glued) to the core side of the band 6a. A similar water proof tape may if desired also be applied to wide tape 5a. As far the rest of the process as illustrated in figures 7 to 11 are concerned they stay the same.

Figure 14 shows a schematic partial cross sectional view of a reinforced edge of a further panel made in accordance with a process as shown in figures 7 to 11 but with the modification shown in figure 13. As may be seen the panel differs from the



panel illustrated in figure 12 in that the waterproof tape 40 abuts the longitudinal side edge of the core and is sandwiched between the core side edge face and the bridge member 36. The presence of the tape 40 during manufacture inhibits the bridge member from being adhered to the core, by way of cementation or embedding. Since the tape is at least substantially waterproof the outer exposed surface of the bridging member, which in this case is provided with lettering in dotted outline, is not covered with cementitious material and the lettering is exposed to view in the final panel product.

As may be seen from figure 14, the tape 40 more or less extends only across the breadth of the core side edge face. Alternatively, as desired or as necessary, a substantially water impervious tape may extend into one or both of the adjacent marginal areas of the broad faces. As mentioned above, a marginal area may have a grip region and an adhesion free region. Referring back to figure 14 examples of the position of such adhesive free regions are designated by the reference numerals 42 and 43; the grip regions occupy the rest of the marginal areas. If a panel is to have one or both adhesion regions 42 and 43 then the above mentioned process for manufacturing described with respect to figures 13 and 14

may for example be modified by using a wider water impervious tape. Figures 13a and 14a relate to such a process for the provision of a panel having such adhesion free zones along both side edges thereof; in figures 13a and 14a the same reference numerals have been used as with respect to figures 13 and 14 to designate common elements. In figure 13a the wider water impervious tape is designated by the reference numeral 40a. As may be seen from figure 14a, the tape 40a in the final panel configuration has a U-shape like cross section (if somewhat flattened); i.e. a U-shape surface including the surface of the longitudinal or side edge is not adhered to the U-shaped reinforcement mesh component, distal end portions only of the strip members are adhered to the marginal edge faces in the grip regions. For the configuration shown in figure 14a the distal part of the strip members is adhered to the core in the grip regions 45 and 46.

In figures 7 to 14a the first and second edge strip members 38 and 39 are more or less of equal length. In accordance with the present invention these strip members may as desired or necessary be of different length. The figures 15 to 17 show schematic partial views of example panels in accordance with the present invention wherein the strip

members are of different length. Figure 15 shows a strip member 38a which is longer than strip member 39a; Figure 16 shows a strip member 38b which is somewhat longer than strip member 39b; Figure 17 shows a strip member 38c which is shorter than strip member 39c.

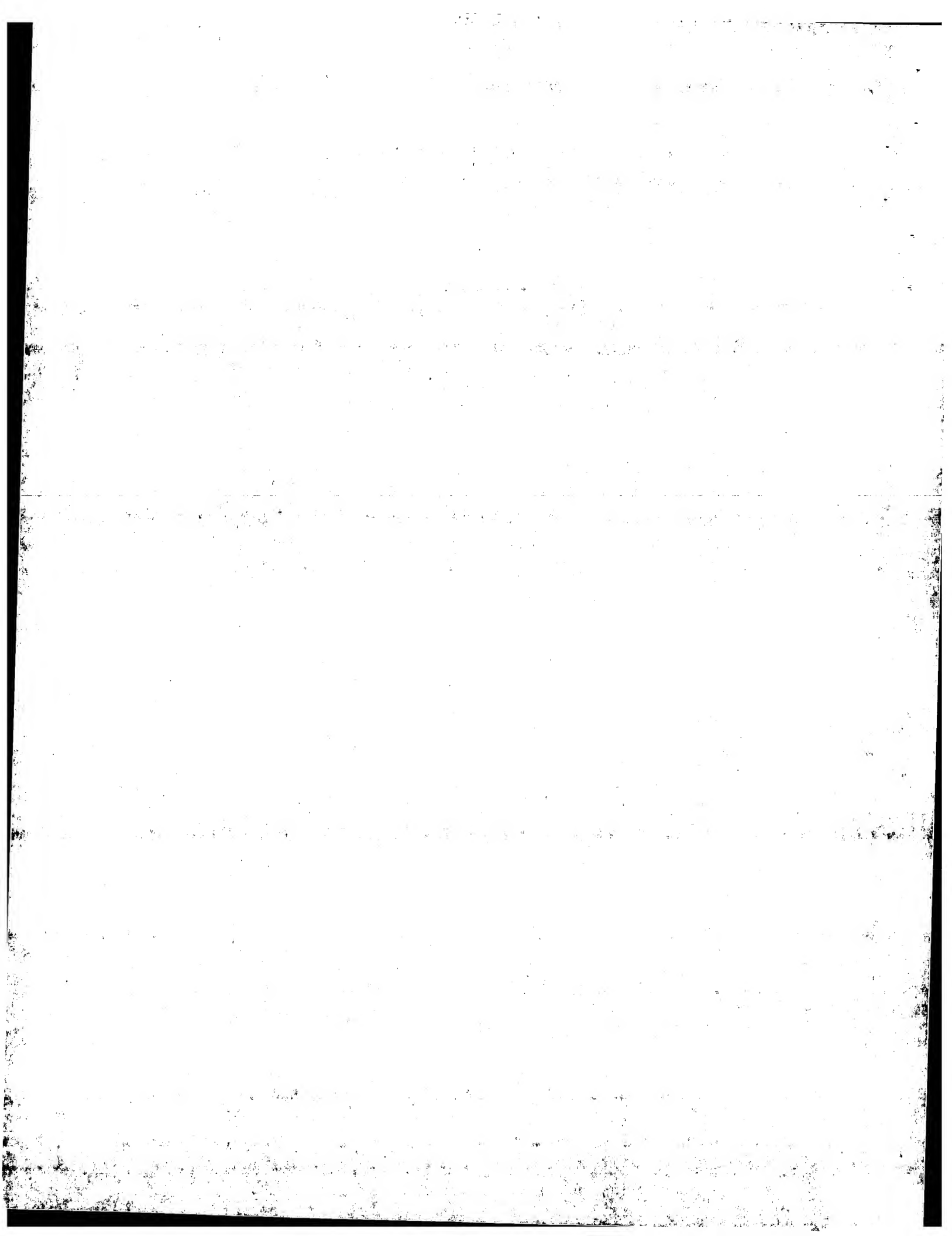
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For purposes of illustration figure 7 to 13 and 14 relate to panels wherein the reinforcement mesh for the broad faces more or less extend the full breadth of the broad face of a panel. However, in accordance with the present invention it is advantageous to have panels wherein the side edges of the reinforcement mesh for the broad faces do not extend the full breadth of the broad face of a panel but are somewhat offset from the panel edge such as may be seen in figures 15, 16 and 17. The offset distance may for example be from 1/8 to 1/4 of an inch. Other offset distance may also be used keeping in mind however that the edge reinforcement mesh are to still overlap the edges of the broad face meshes in the marginal areas of the broad faces. The offset regions are designated by the reference numerals 41a and 41b in figures 15 to 16. In order to accommodate such offset regions the process steps discussed above with respect to figures 7 to 13 and 14 may be modified for example by using broad face meshes which are

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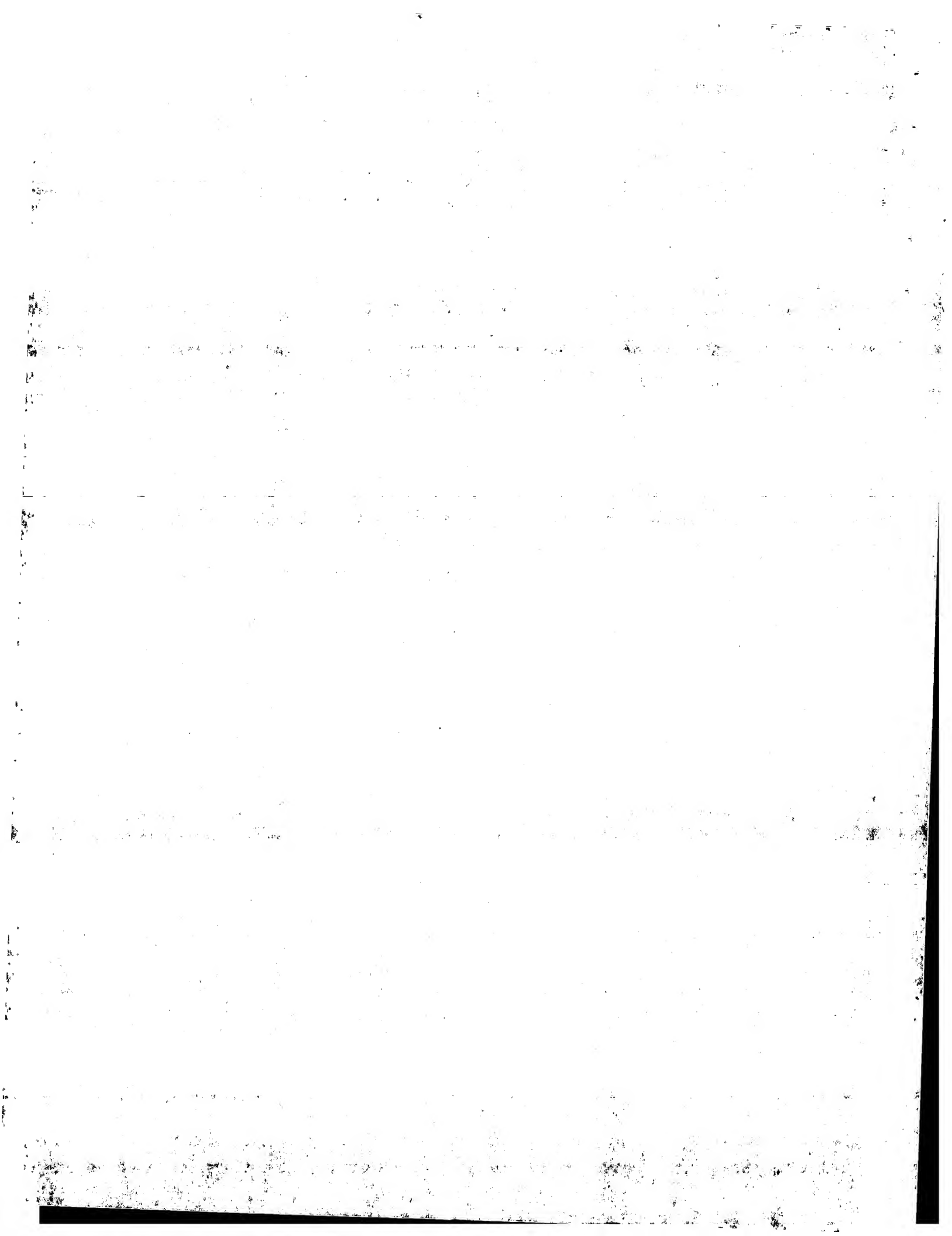
still centered in place as shown in these figures but for which the width at each side edge is shorter by the above mentioned amounts(i.e. shortened by from 1/ 8 to 1/4 of an inch); in this case the core mix would be laid down so as to extend beyond the broad mesh edges for example by the above
5 mentioned offset distances.

Turning now to figures 18 to 21, these figures illustrate an apparatus for the preparation of an example panel in accordance with the present invention exploiting an example
10 method of manufacture also in accordance with the present invention.

Figure 18 illustrates an upstream portion of the example apparatus; figure 19 illustrates a central portion of the
15 example apparatus; figure 20 illustrates a downstream portion of the example apparatus; Figure 21 illustrates an alternate upstream portion of the example apparatus which similar to that shown in figure 18 but which includes a tape application zone; and figure 22 illustrates an upstream band feeding
20 station for feeding a pair of side reinforcement band meshes to the apparatus upstream portion shown in figure 18.

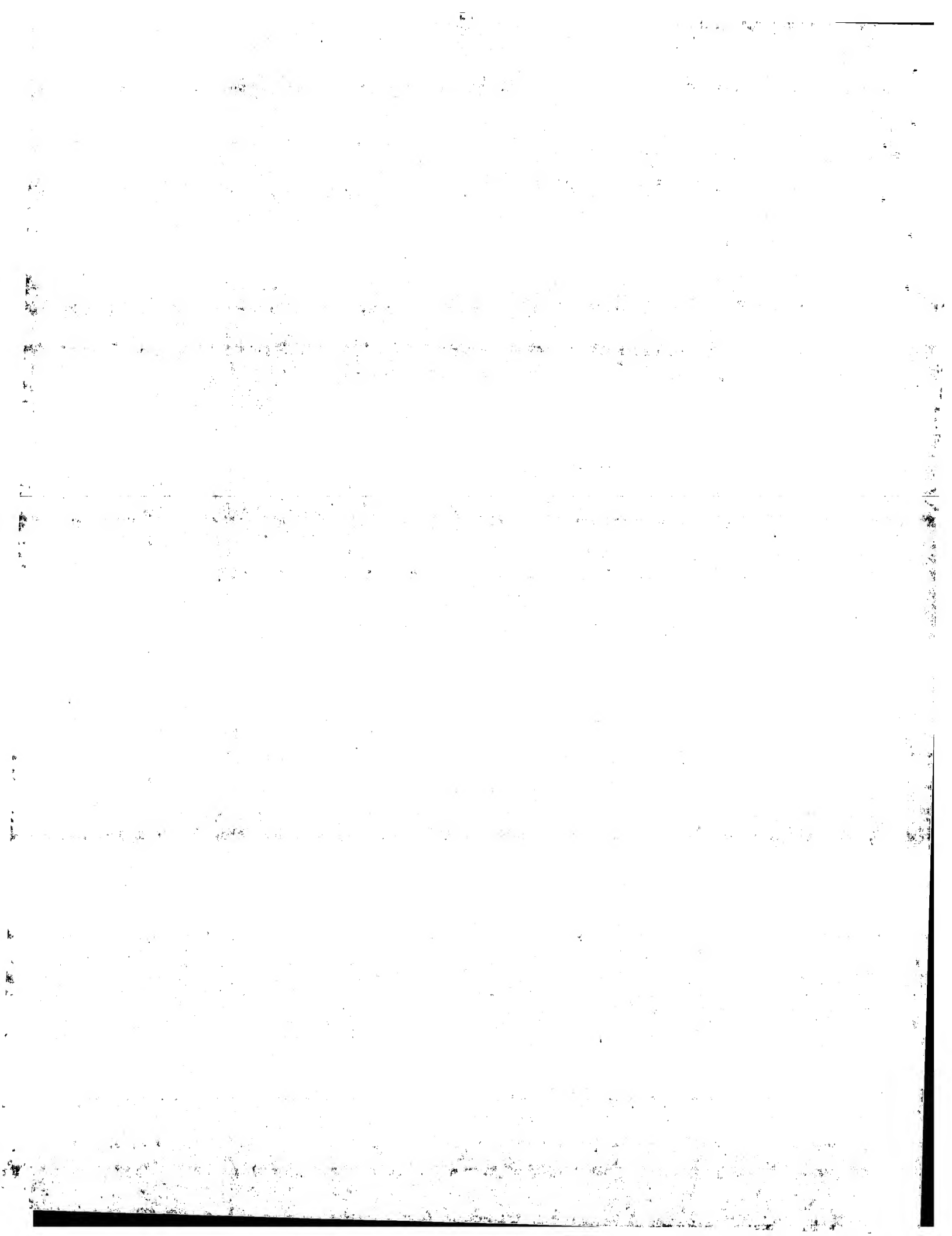
Referring to figure 18, the apparatus has a conveyor system comprising an endless conveyor belt 50 as well as attendant drive and return rollers; return roller 52 is shown in figure 18; the drive roller (not shown) is located at the other end of the conveyor belt and is configured in any suitable manner so as to be able to induce movement of the belt such that it travels in working direction as shown by the arrow. The apparatus also has a support or forming table 54. The conveyor system and the table 54 are arranged such that the conveyor belt 50 is able to slidably travel over the surface of the table 54 such that the table is able to support the conveyor belt as well as any material disposed thereon.

The apparatus includes a protective film alignment component for alignment of a protective film 55 onto the conveyor belt. The protective film 55 is feed from a roll of such film (not shown). A protective film 55 is laid onto the belt so as to protect it and avoid the necessity of applying a release agent thereto. The film 55 should be wider than the board's width, for example wider by at least 5" to 7" or more. The protective film 55 may for example be made of polyethylene 3.0 to 5.0 mils in thickness.



The protective film alignment component comprises an alignment bar 56 as well as support members 57 and 58 which maintain the alignment bar 56 a predetermined distance above the conveyor belt 50. The alignment bar 50 is suitably fixed to the support members 57 and 58 (e.g. as by welding, bolting, etc.); the support members 57 and 58 are similarly fixed to the table 50.

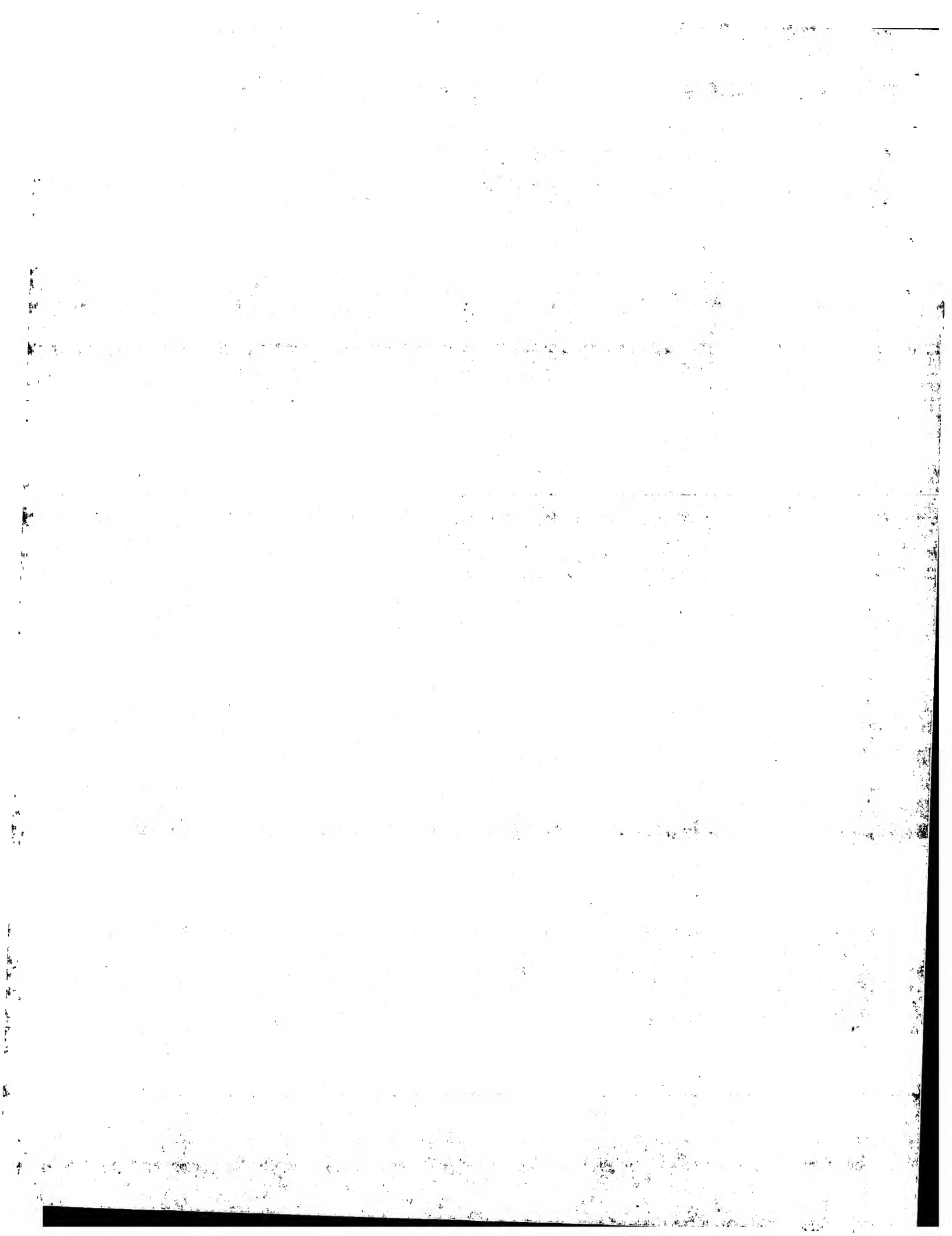
Further downstream the apparatus has a side edge reinforcement deposit station for depositing a pair of spaced apart bands 60 and 62 of reinforcement mesh onto the protective film. The side edge reinforcement deposit station has pair of edge band alignment components 64 and 66 which are releasably slidable along a transverse rail element 67 fixed to side edges of the table by upright support members 68 and 69 such that the rail element 67 is suitably spaced above the conveyor belt. The rail element comprises two parallel spaced apart tracks. These band alignment components are configured so as to be positioned for depositing, onto the protective film, the two parallel bands 60 and 62 of reinforcement mesh in the appropriate marginal positions according to a panel's or board's desired width. The bands 60 and 62 may be of sufficient width (e.g. 4" to 5") so as to cover the upper and



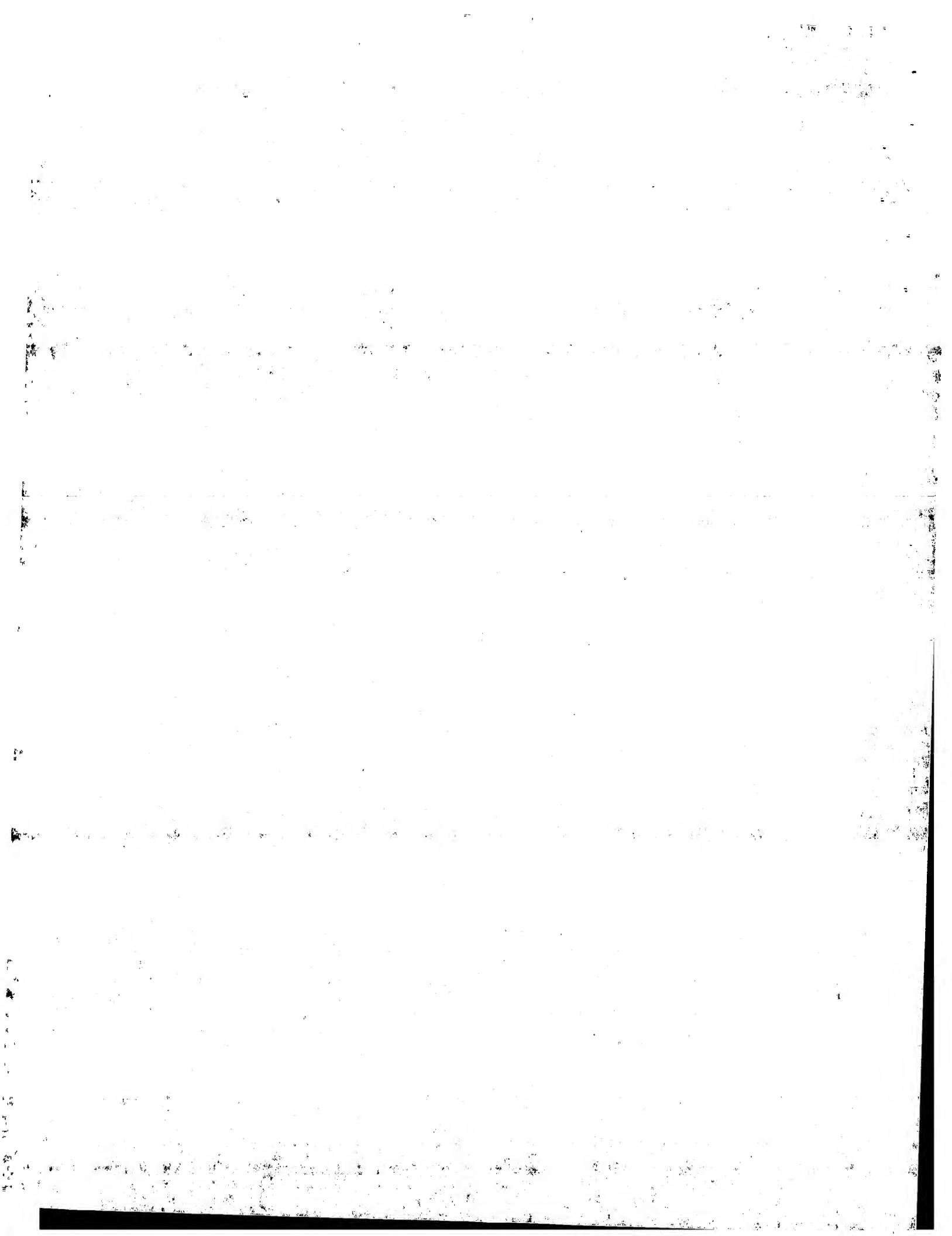
lower marginal edge areas (2" to 3" wide) and provide a 1" minimum overlap of the upper and lower broad face reinforcement meshes referred to below.

5 The bands 60 and 62 of reinforcement mesh may for example be made of a synthetic non-woven non-oriented material. These bands 60 and 62 may for example have a thickness of 0.010" and 0.020" and a density of 2 to 4 oz per square yards. The bands 60 and 62 may for example be of polypropylene. The bands 60 and 62 may for example be in the form of a roll of a diameter
10 of 20" to 50" but preferably 30", e.g. in order to give a length of 500 to 1000 linear yards.

The band alignment components 64 and 66 each have a rail grip member respectively designated by the reference numbers 71 and
15 72 for releasably gripping the rail element 67 so as to releasably attach these components to the rail element 67 at a predetermined position thereon. Each band alignment component 64 and 66 comprises an upper support arm (respectively designated by the reference numbers 74 and 75) and a lower
20 slide bar arm (respectively designated by the reference numbers 76 and 77) which are attached to an upright support plate (respectively designated by the reference numbers 78 and

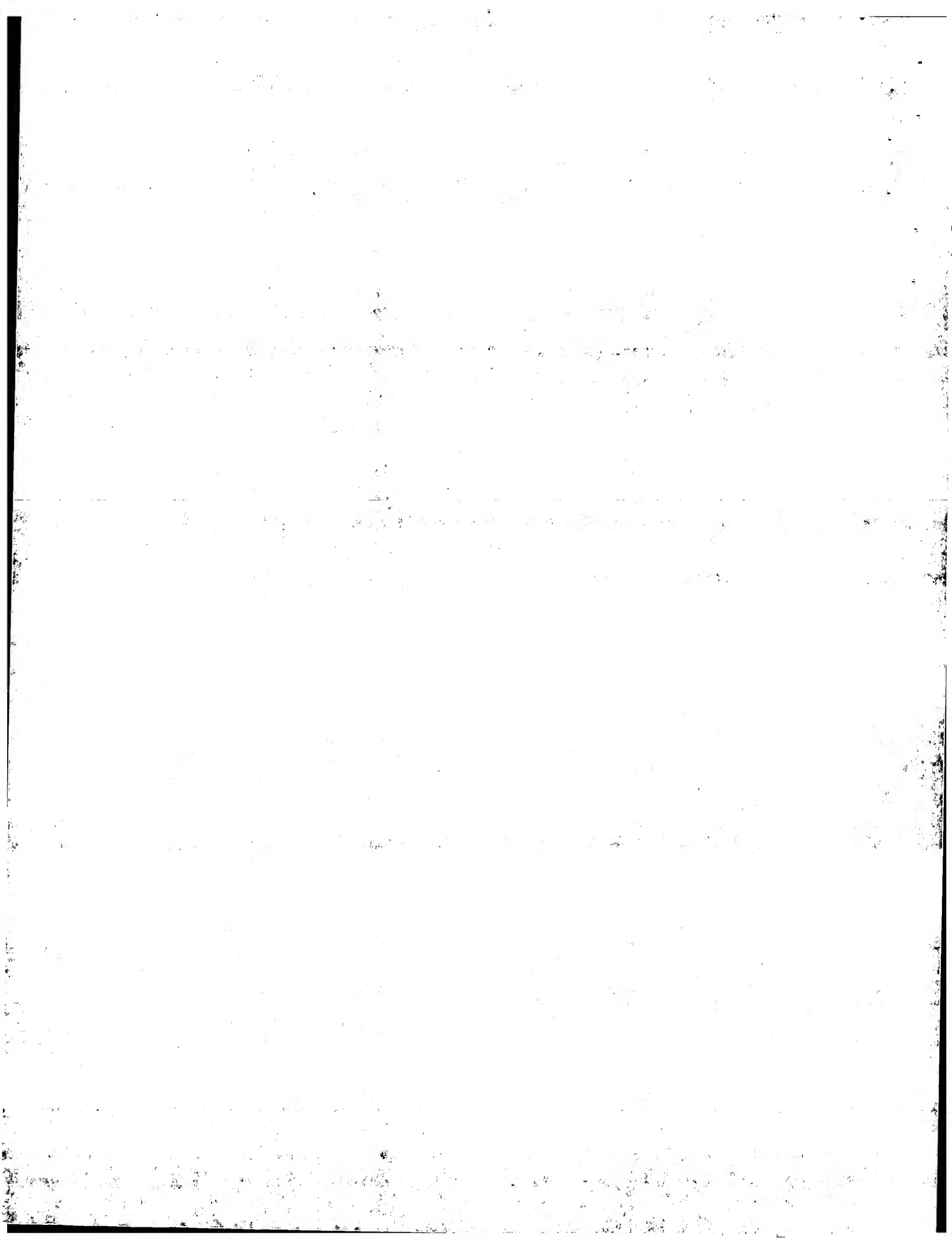


79) which projects from each of the rail grip members 71 and 72 transversely to the longitudinal axis of the rail element 67. The upper support arms 74 and 75 project more or less at a right angle from a respective the plate 78 or 79 to which they are fixed in any suitable fashion (e.g. by welding). The lower slide bar arms 76 and 77 are respectively pivotally attached to plate 78 and 79 by any suitable pivot means 80 and 81 (e.g. a hinge). The band alignment components each respectively have a crescent plate 82 and 83 fixed at the distal ends of upper support arms 74 and 75; these crescent plates 82 and 83 are each provided with an arc shaped alignment slot 84 or 85. The distal end of each of the lower slide bar arms 76 and 77 respectively has an upturned threaded end portion which extends upwardly at right angles to the rest of the slide bar arm through a respective slot 84 and 85. A respective tightening nut 88 or 89 is disposed on a respective threaded end portion above a respective plate 82 or 83. Just adjacent the underside of each plate 82 and 83 a respective upper end portion has a respective transversely projecting ridge member disposed such that as a respective nut 88 or 89 is screwed downwardly the ridge member can abut the underside of a respective plate 82 or 83 so as to clamp a respective lower slide bar arm 76 or 77 at a predetermined arc position.



Loosening the nuts 88 or 89 allows the lower slide arm bar 76 or 77 to be pivoted about the pivot means 80 or 81 to a desired arc position.

Each of the rail grip members 71 and 72 is also configured so as to be able to releasably clamp a respective band alignment component 64 or 66 at a predetermined position on the rail element 67. The grip members 71 and 72 each have upper clamp plates (respectively designated by the reference numbers 91 and 92), lower clamp plates (respectively designated by the reference numbers 94 and 95) and a pair of releasable tightening bolts (respectively designated by the reference numbers 97 and 98). The upper clamp plates 91 and 92 are provided with unthreaded openings through which the shafts of the bolts 97 and 98 project. On the other hand the lower clamp plates 94 and 95 are provided with threaded openings which are able to engage the corresponding thread of the shafts of the bolts 97 and 98 passing thereinto through the slot between the tracks of the rail element 67. As may be understood rotation of the bolts 97 or 98 in one direction will tend to tighten a respective clamp plate to the rail element 67 for fixing a respective alignment component 64 or 66 to the rail element 67 while rotation in the opposite



direction will tend to loosen the grip of the clamp plates on the rail element 67 so that the alignment component 64 or 66 may be displaced as desired along the rail. The position of the slide bar arms 76 and 77 is thus adjustable.

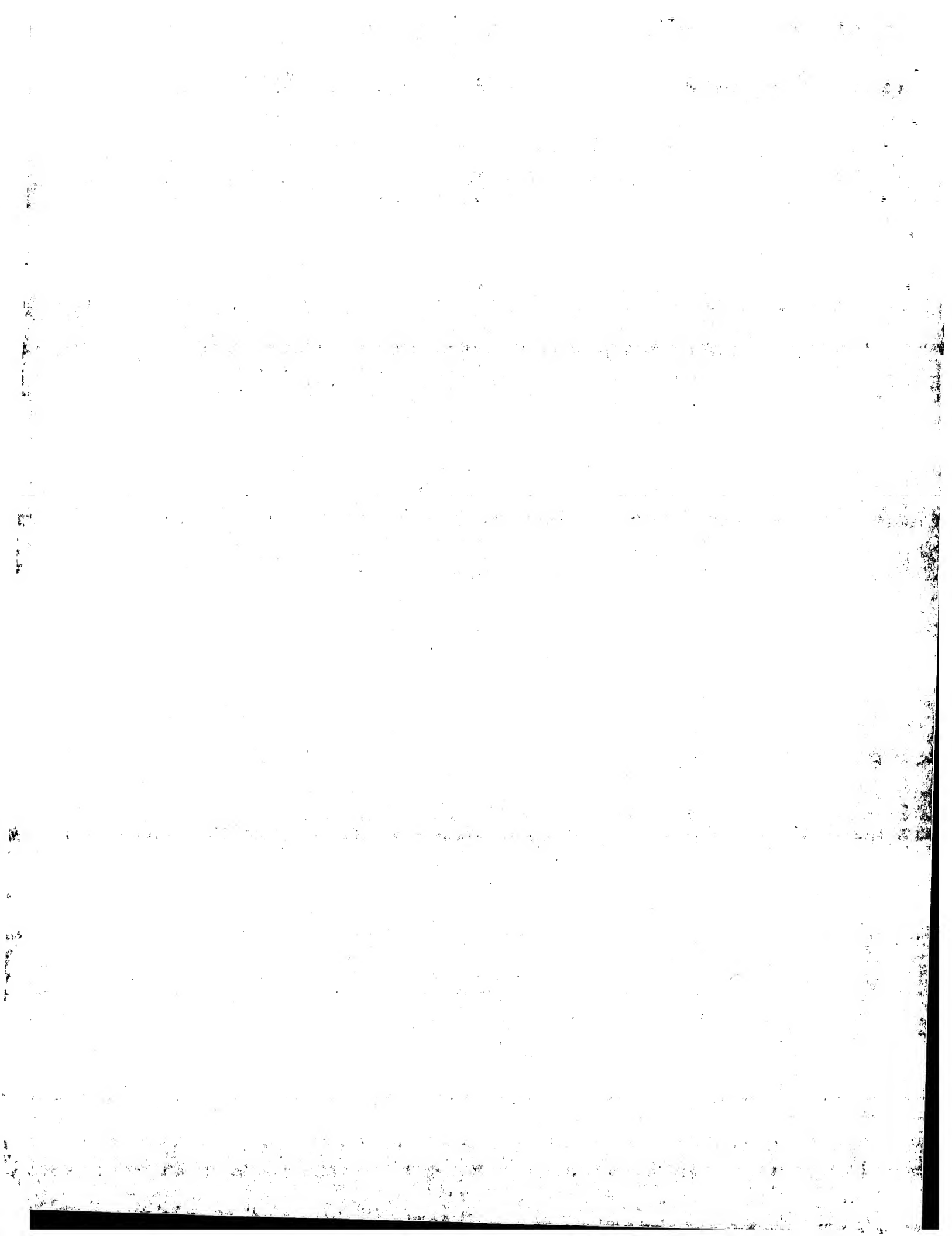
5 As is shown in figure 18, both slide bar arms 76 and 77 are able to be maintained at an angle of 45 degrees with respect to the direction of travel of the conveyor belt such that the bands 60 and 62 being fed thereto at an angle more or less perpendicular to the direction of travel of the conveyor belt
10 50 are able to change direction and be deposited in parallel spaced relationship onto the protective film 55. The adjustability of the band alignment components 64 and 66 means that they can also be moved to different positions in order to produce panels of different width (e.g. panels having a width
15 of 32", 36" or 48" wide boards).

The bands 60 and 62 may for example be aligned so that their edges are not outside the edges of the protective film 55. The distance between the outer edges of the bands 60 and 62
20 and the outer edges of the protective film 55 may for example be from 0" to 0.5".

Referring now to figure 19 the apparatus has a first broad face reinforcement deposit station for depositing a bottom or lower mesh layer onto the protective film 55 and the bands 60 and 62. The first broad face reinforcement deposit station has a first mesh layer alignment component for depositing the bottom or lower layer of reinforcement mesh 100 onto the protective film 55 so as to overlap portions of each of the above mentioned side edge reinforcement bands 60 and 62. For the present example apparatus the lower layer of the reinforcement mesh 100 is sized and centred so that the distance between the outer edges of the reinforcement mesh 100 and respective outer edges of the reinforcement bands 60 and 62 are more or less the same. The lower layer of reinforcement mesh 100 may be of fibreglass or polypropylene.

The first mesh layer alignment component comprises an alignment bar 102 as well as support members 104 and 105 which maintain the alignment bar 102 a predetermined desired distance above the conveyor belt 50. The support members 104 and 105 may be adjustable or non adjustable as desired or necessary.

In figure 19 the support members are shown as being adjustable



such that the alignment bar may be displaced upwardly and downwardly as well as forwardly in the direction of travel of the conveyor belt and backwards in the opposite direction. The following description will be given with respect to support member 104 but the same reference numbers will be used to designate the common elements of support element 105.

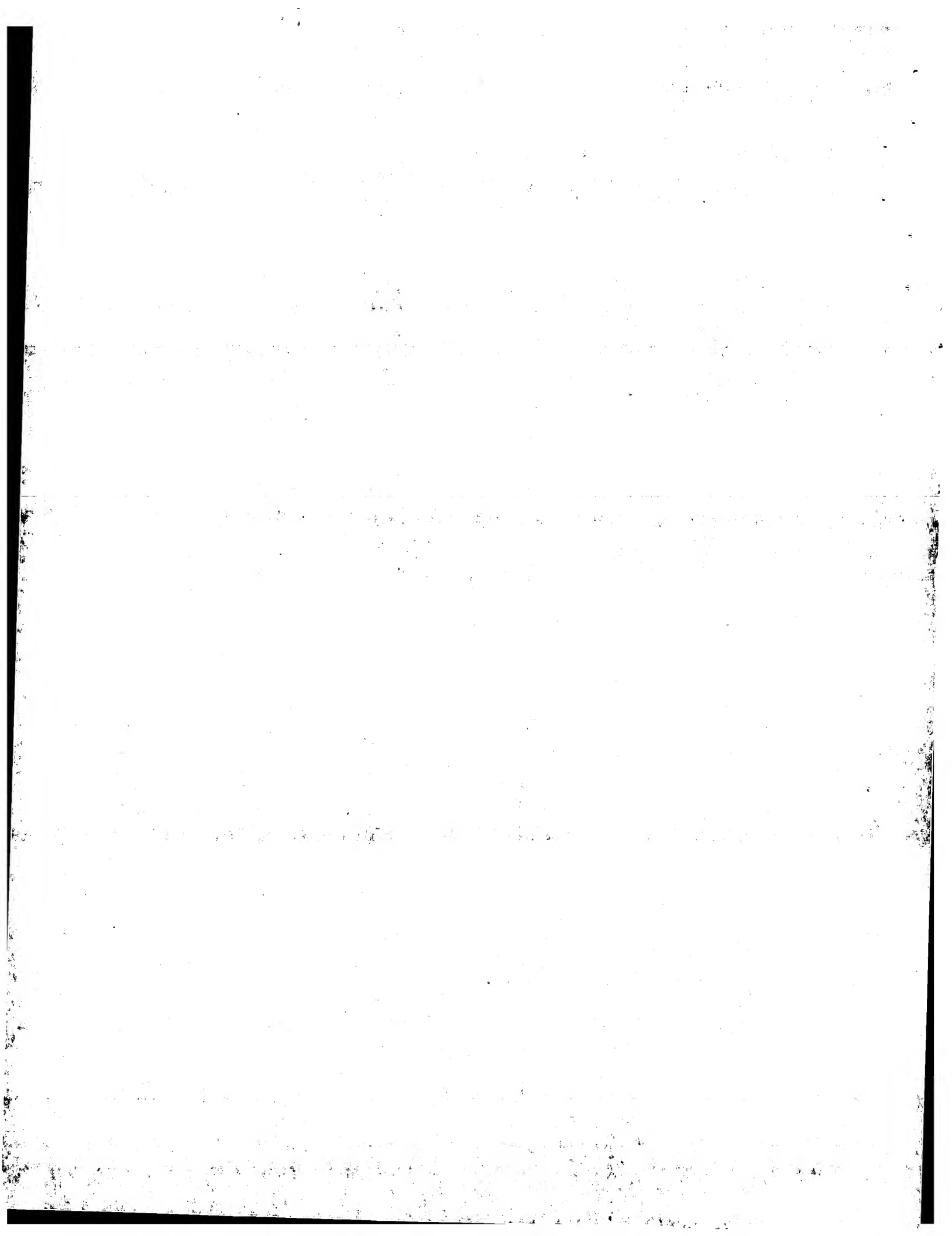
Referring to figure 19, 19a, 19b and 19c the support member 104 has an upright support element 107 provided at the top thereof with a crown element 108 fixed thereto having a threaded channel. The support member 104 has a first crank 109 provided with a threaded shaft 110, a crank handle 111 at one end and at the other distal end an abutment head 112. The threaded shaft 110 is in screw engagement with the threaded channel of the crown element 108. The abutment head 112 is rotatably attached to a further crank body by fixing the outer shell 115 of a bearing member to the crank body 114 and fixing the inner bearing element 116 which is rotatable with respect to the outer shell 115, to the abutment head 112. In this way rotation of the crank 109 in one direction will cause the head 112 to rotate and push against the crank body 114 while rotation in the opposite direction will cause the head 112 to pull the crank body 114. The support member 104 includes an

additional or second crank 117 which is connected in analogous fashion to the crank body 114 and an alignment bar attachment member 119 which in turn is attached to the alignment bar 102 such that rotation of the crank 117 through the crank body 114 either induces the bar 102 to be raised or to be lowered.

5 With respect to the second crank 117, the same reference numbers are used to designate elements which are common with the first crank 109.

Figures 19a, 19b and 19c show in detail the above described
10 dual crank system for the support member 104.

The apparatus has a slurry station comprising a pair of slurry edger rail elements 121 and 122, a slurry scrapper or screed bar element 125 and a slurry delivery system. The purpose of
15 the slurry station is to facilitate adherence of the reinforcement mesh 100 to the core mix by first embedding the mesh 100 in a slurry layer prior to the deposit of the core mix thereon; this slurry layer will also serve to create a smooth side face for the panel. However if desired this
20 slurry station may be omitted. If the slurry station is omitted other steps may have to be taken to ensure that the reinforcing mesh is adhered to the panel surface in the



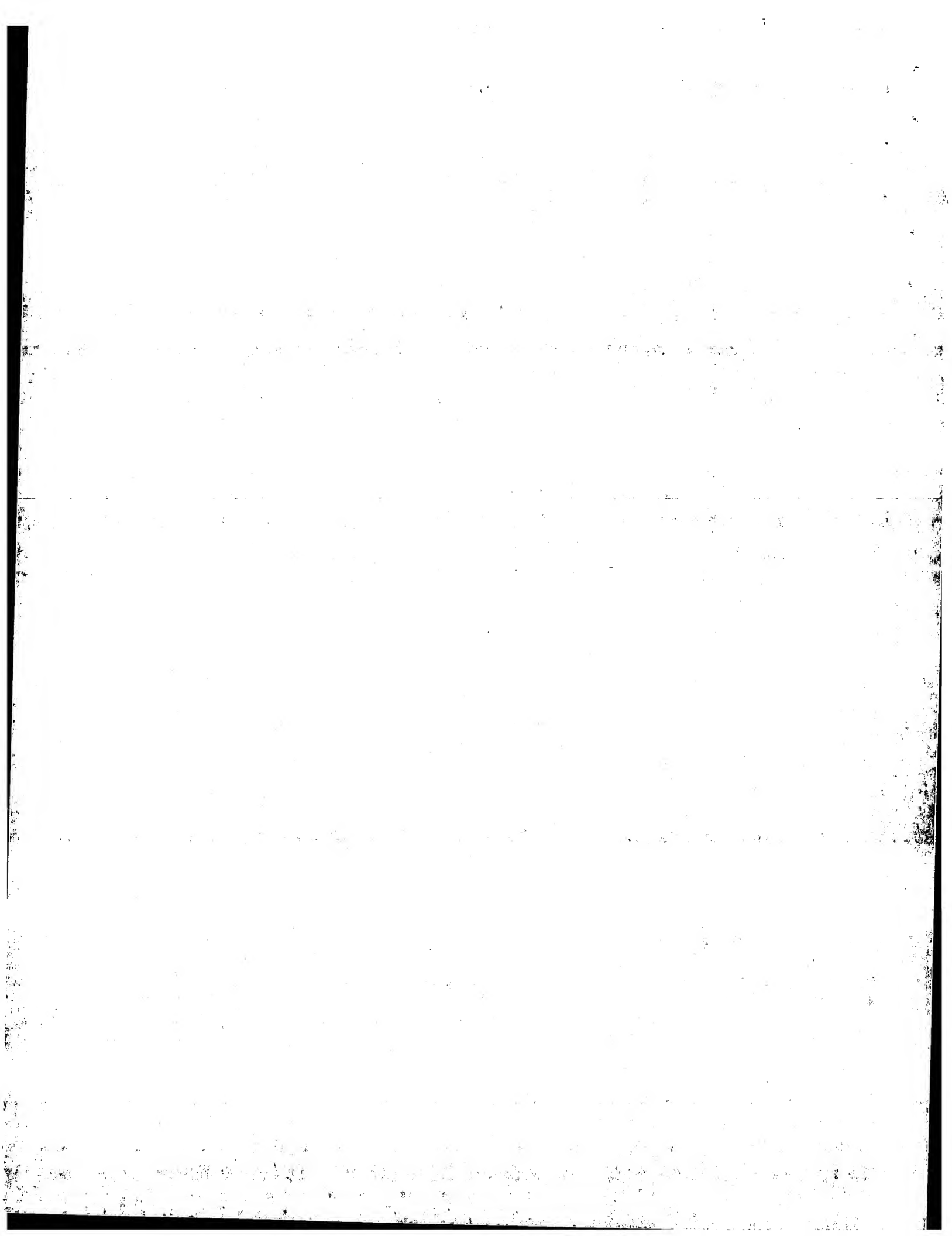
desired or necessary fashion e.g. by being embedded therein.
For example, the formulation of the concrete mix may be
modified so as to facilitate the embedding of the bottom mesh
therein; please see U.S. patent no. 5,221,386 column 8 lines 1
to 31 for a description of such a potential core mix; the
entire contents of this patent are hereby incorporated by
reference.

The slurry edger rail elements 121 and 122 are directly
attached to the table 54 by connector elements 128 and 129 and
indirectly by elements 130 and 131 attached to legs 134 and
135 of a support structure 137 for supporting a slurry holding
container 140. The edger rail elements 121 and 122 are fixed
in place such that the lower edge of each of the edger rail
elements 121 and 122 is spaced apart from the table 54 a
distance sufficient to allow the conveyor belt 50, protective
film 55 and any desired layer or layers of reinforcing mesh to
pass between. This distance however is such that the slurry
deposited on the lower mesh 100 is inhibited from spreading
laterally beyond these edger rail elements 121 and 122. The
edger rail elements 121 and 122 are also spaced apart a
desired predetermined distance so as to assure that a
predetermined constant width of slurry is deposited on the

lower mesh 100.

The slurry scrapper or screed bar element 125 is attached to the support structure 137 for the slurry holding container 140 by support arms 142 and 144 such that the lower edge of the
5 screed bar element 125 is spaced apart from the table 54 so as to define a screed distance (i.e. a nip) sufficient to allow the conveyor 50, a protective film 55 and any desired layer or layers of reinforcing mesh to pass therebetween. This screed distance however is such that the slurry deposited on the
10 lower mesh 100 and which passes under the screed bar element 125 forms a slurry layer of predetermined depth in which the lower mesh 100 is more or less embedded. The screed bar element 125 may be of rubber.

15 As may be appreciated, the slurry edger rail elements 121 and 122 and the slurry scrapper or screed bar element 125 form a type of U-shaped raised barrier dam structure having lower edges which are spaced apart from the table sufficient above described respective spacing distances. By suitable
20 manipulation and synchronisation of the speed of the conveyor belt 50 and the flow rate of slurry onto the lower mesh 100 more or less at the mouth of the dam, slurry suitably



deposited on the lower mesh 100 may be made to backflow and create an upstream slurry pool 145 within the U-shaped barrier dam which may be generally deeper than these spacing distances. In this manner a slurry layer may be continuously laid down in which the lower mesh 100's embedded.

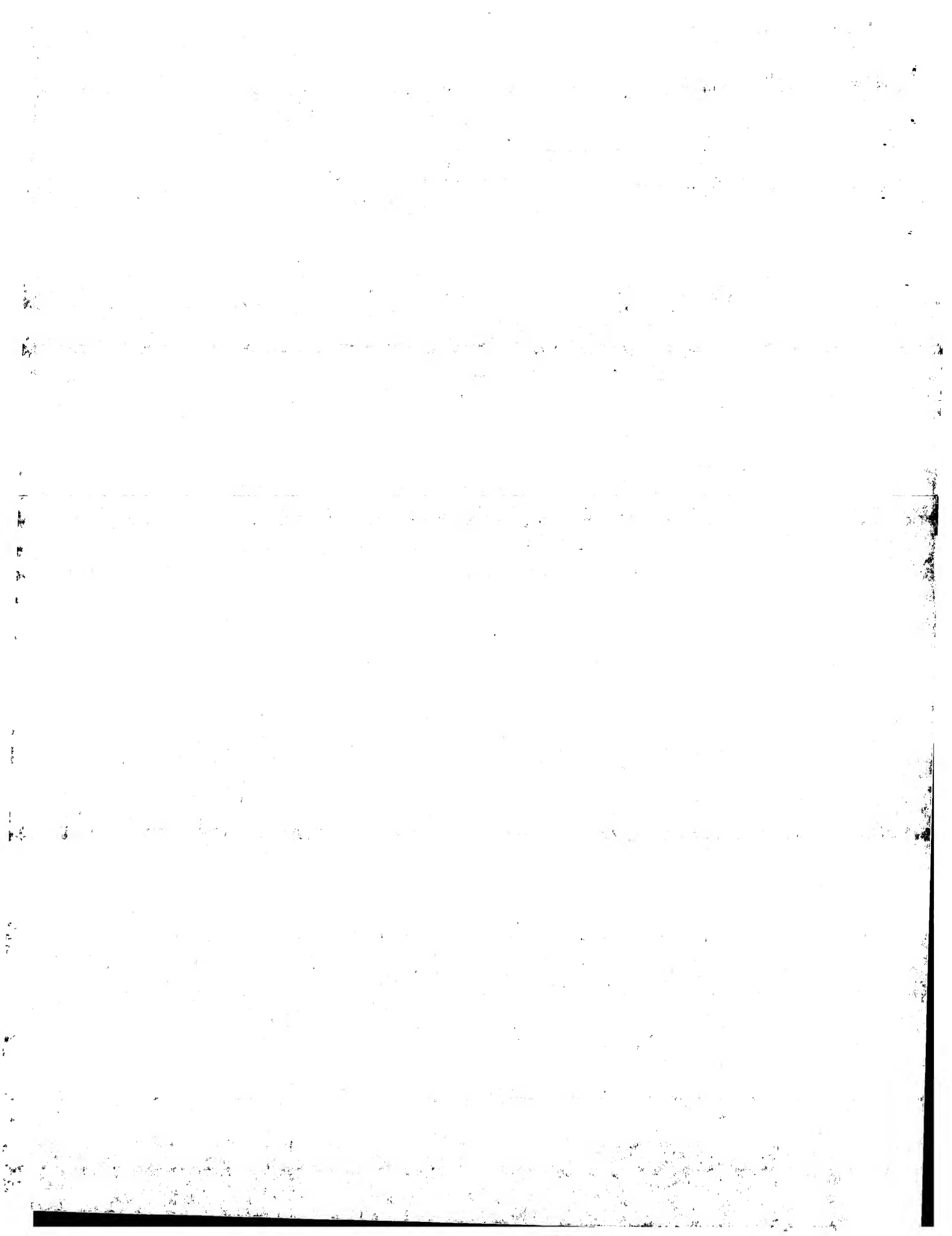
5 The slurry delivery system comprises the slurry holding container 140, an agitator 147 and a controllable slurry outlet member indicated generally by the reference number 150. The slurry holding container 140 is supported by the support structure 137, the container 140 being attached to the support
10 structure 137 in any suitable fashion e.g. bolting. The agitator is connected to a motor (not shown) for rotation of the agitator. The components of the slurry may be mixed together in a separate container (not shown) and thereafter be delivered to the slurry holding container 140 in any suitable
15 fashion (e.g. through appropriate ducting or manually); once in the slurry holding container 140 the agitator functions to maintain the slurry in a more or less homogenous mixed state prior to its being released onto the lower mesh 100 .
Alternatively, if desired or as necessary the slurry
20 components may be delivered in any suitable fashion directly to the slurry holding tank 140 where they may be mixed due to the influence of the rotating agitator 147. The controllable

slurry outlet member 150 may include a valve (not shown), such as a gate valve, which may be (spring) biased in a closed position. The valve may be connected to a solenoid type means whereby in response to an electrical signal the valve may be opened so as to release slurry onto the lower mesh 100 at
5 timed intervals synchronised with the movement of the lower mesh 100 thereunder. The outlet member 150 is disposed such that the slurry deposited on the lower mesh 100 may be maintained within the confines of the above described U-shaped barrier dam and form the above mentioned slurry pool 145.

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The apparatus also has a core mix station which is similar in general makeup to the slurry station. The core mix station comprises a pair of core mix edger rail elements 155 and 156,
15 a core mix screeding roller component 158 and a core mix delivery system. The purpose of the core mix station is to deposit core mix onto the slurried lower mesh 100 so as to form a core mix layer covering the breadth of the lower mesh.

The core edger rail elements 156 and 157 are directly attached
20 to the table 54 by connector elements 159 and 160 and indirectly by elements 161 and 162 attached to legs 164 and 165 of a support structure 167 for supporting a screed roller



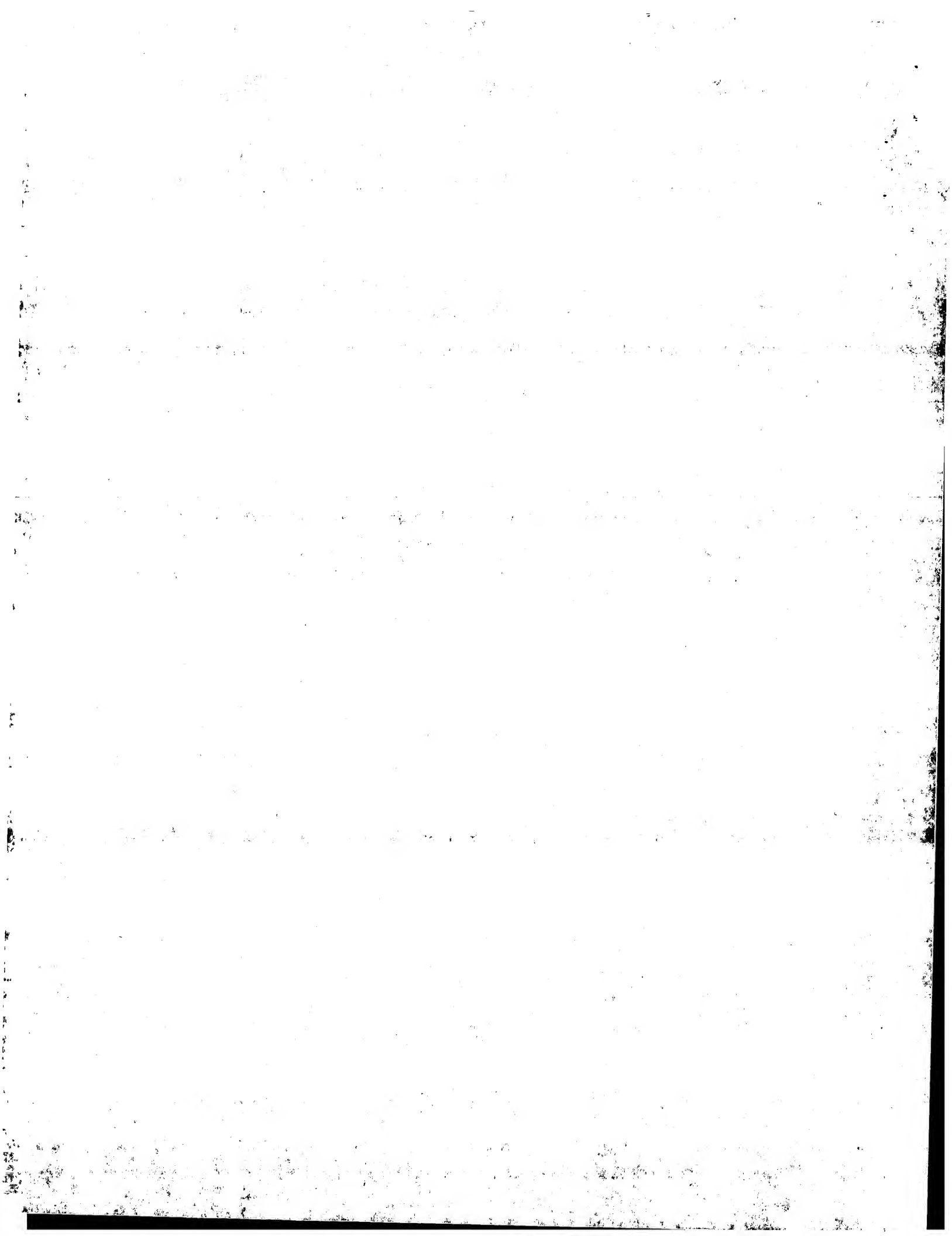
170 such that the lower edge of each of the rail elements 155 and 156 is spaced apart from the table 54 a distance sufficient to allow the conveyor 50, protective film 55 and any desired layer or layers of reinforcing mesh to pass therebetween. This distance however is such that the core mix deposited on the slurried lower mesh is inhibited from spreading laterally beyond these edger rail elements 155 and 156. The edger rail elements 155 and 156 are also spaced apart a desired predetermined distance so as to assure that a constant width of core mix is deposited on a slurried lower mesh. The core edger rail elements 155 and 156 may be of high molecular weight polyethylene.

The core mix screeding roller component comprises a screed roller 170 and the support structure 167 for holding the roller 170 in place. The roller 170 may have a (poly)urethane covered surface. The roller 170 has shaft elements 172 and 174 fixed at opposed ends thereof. These shaft elements 172 and 174 are each engaged in respective bearing means (not shown) provided in the cross members 176 and 178; these bearing members allow the screed roller 170 to be rotated about a longitudinal axis. The shaft 172 is attached to a motor (not shown) for urging the clockwise rotation of the

screed roller 170; the motor is suitably configured for example to rotate the screed roller 170 clockwise in the same direction as the conveyor belt 50 but at a speed slower than the speed of the conveyor belt 50.

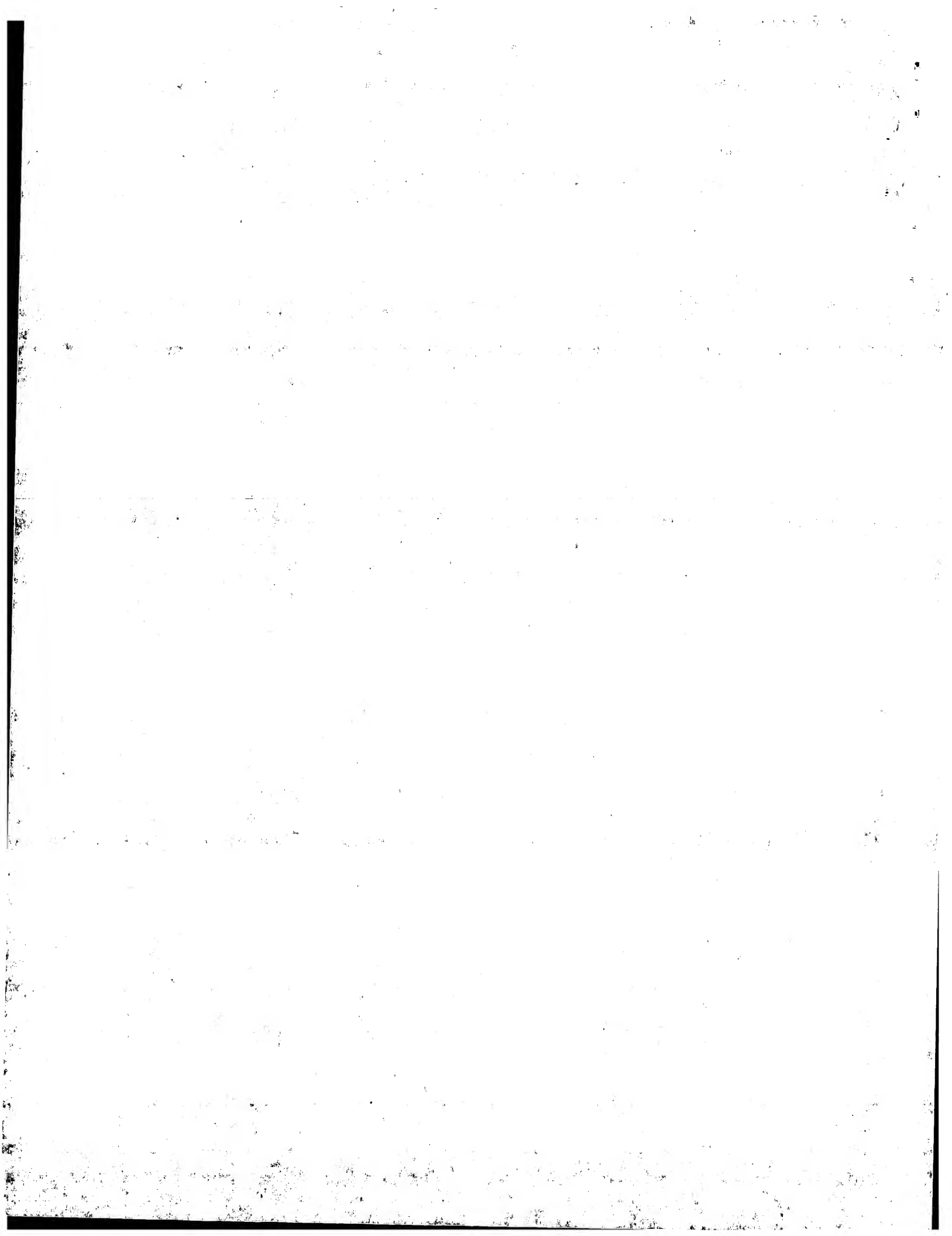
- 5 The screed roller 170 may be fixed in place or be vertically adjustable so as to vary the nip between the roller and the conveyor belt. In figure 19 the screed roller is illustrated as being vertically adjustable.
- 10 The cross members are vertically displaceable by a crank system analogous to that shown in figures 19a, 19b and 19c such that the screed roller 170 may be displaced up and down so that the nip between the roller 170 and the conveyor belt 50 may be set to the desired core mix layer thickness. The
- 15 crank system includes a single crank component (the cranks being designated by the reference numbers 180 and 181. The side ends of the cross members 176 and 178 are each provided with key elements slidably engaged in slots on the inside parts of the roller support structure 167; one of the slots is
- 20 designated with the reference number 184.

As may be appreciated, the screed roller 170 and core mix



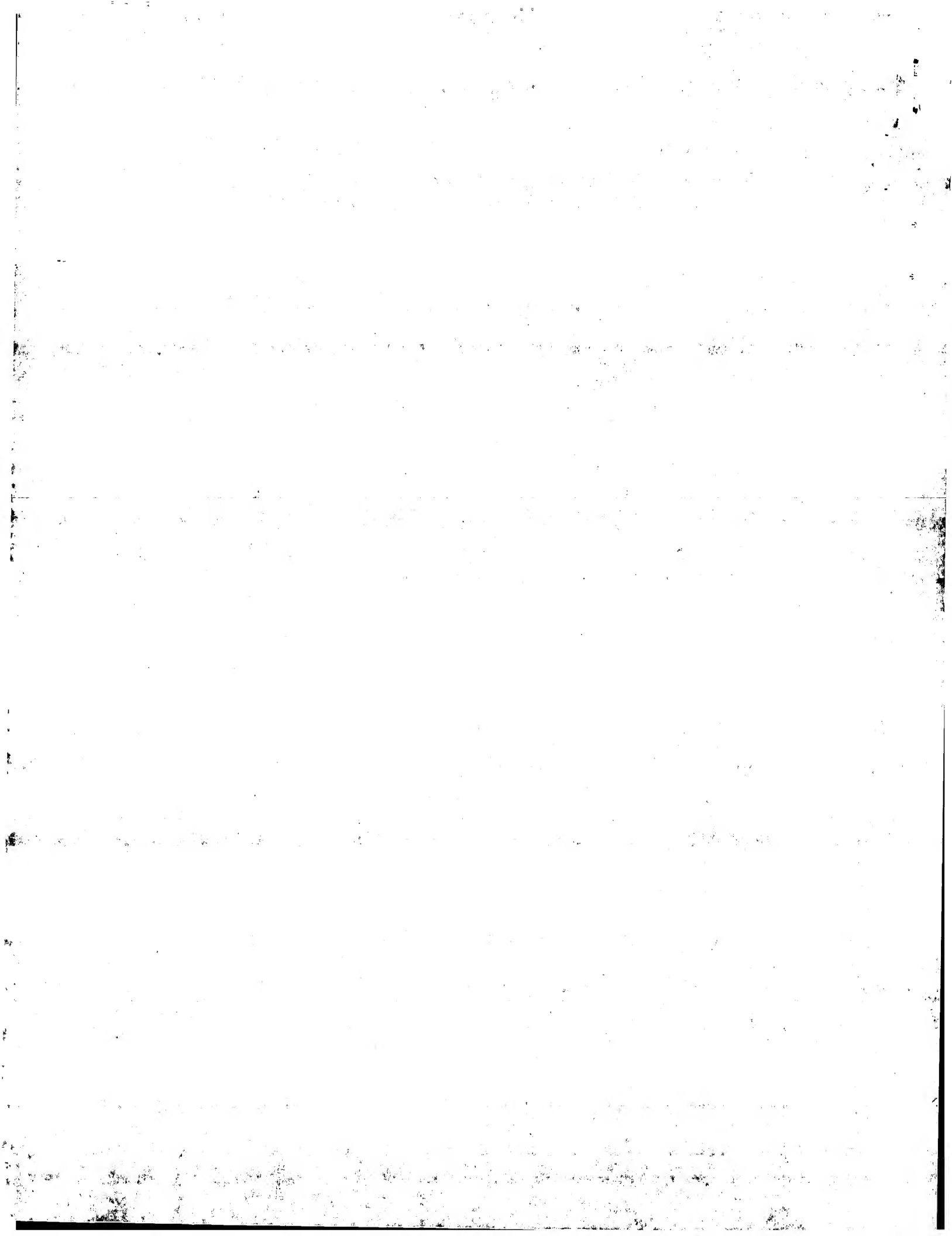
edger rail elements 155 and 156 also form a type of U-shaped raised barrier core mix dam structure having lower edges which are spaced apart from the table 54 sufficient above described respective spacing distances. By suitable manipulation and synchronisation of the speed of the conveyor belt 50 and the flow rate of core mix onto the lower mesh more or less at the mouth of this core mix dam, core mix suitably deposited on a lower mesh may be made to backflow and create an upstream core mix mass 190 within the U-shaped barrier dam which may be generally deeper than these spacing distances, (i.e. in particular deeper than the screed roller nip). In this manner a core mix layer 191 may be continuously laid down over the slurried lower mesh.

The core mix delivery system comprises the core mix holding container 192, an agitator 193 and a controllable core mix outlet member indicated generally by the reference number 195. The core mix holding container 192 is supported by the support structure 196. The agitator 193 is connected to a motor (not shown) for rotation of the agitator. The components of the core mix may be the same as for the slurry but including aggregate and if desired an air entraining agent or other desired or necessary components. The components of the core



mix may be mixed together in a separate container (not shown) and thereafter be delivered to the core mix holding container 192 in any suitable fashion (e.g. through appropriate ducting or manually); once in the core mix holding container 192 the agitator functions to maintain the core mix in a more or less homogenous mixed state prior to its being released onto the slurried lower mesh. Alternatively, if desired or as necessary the core mix components may be delivered in any suitable fashion directly to the core mix holding tank 192 where they may be mixed due to the influence of the rotating agitator. The controllable core mix outlet member 195 may include a motorised archimedes screw for delivering core mix onto the slurried lower mesh at timed intervals synchronised with the movement of the slurried lower mesh thereunder; the rotation of the screw may for example be controlled by a timer mechanism which controls the energisation and denergisation of the screw motor. The outlet member 195 is disposed such that the core mix deposited on the slurried lower mesh may be maintained within the confines of the above described U-shaped barrier core mix dam and form the above mentioned core mix mass.

Turning to figure 20 the apparatus has a second broad face



reinforcement deposit station for depositing a bottom or lower mesh layer onto the core mix layer.

The second broad face reinforcement deposit station has a layer alignment component for depositing a top or upper layer of reinforcement mesh 200 onto the core mix. For the present example apparatus the top layer of the reinforcement mesh 200 is sized and centred so that the distance between the outer edges of the top reinforcement mesh 200 and outer edges of the reinforcement bands 60 and 62 are more or less the same as that for the lower layer of reinforcement mesh 100. The top layer of reinforcement mesh 200 may be of fibreglass or polypropylene. **

The top or upper mesh layer alignment component comprises same type of elements as the above described lower mesh layer alignment component so the same reference numerals designate the common components. Essentially the top or upper mesh layer alignment component comprises an alignment bar 102 as well as a dual crank system as described above for adjusting the position of the bar 102.

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Still referring to figure 20 the apparatus has a finishing station. The finishing station comprises a pair of guide fork

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elements 211 and 212, a pair of opposed finishing edge rail elements 214 and 216, a vibratable floatable screed plate member 220 and a pair of edge compression ski components 222 and 224.

5 The guide fork elements 211 and 212 each comprise gibbet like support member and a prong end having a pair of downwardly extending prongs or fingers generally designated by the reference numerals 226 and 227. The gibbet like support members are attached to the table.

10 The finishing edger rail elements 214 and 216 each have guide flange ends 230 and 232 which taper in the upstream direction such that the inner face tapers towards the outer face thereof and the top face tapers downwardly. The tip ends (one of
15 which is designated with the reference number 234) of the guide flange ends 230 and 232 are each disposed more or less just below the prong end of a respective guide fork element 211 and 212, i.e. just below the gap between the two prongs. The guide fork elements 211 and 212 and the guide flange ends
20 230 and 234 cooperate to urge marginal mesh regions as well as the marginal regions of the protective film from an initial horizontal position upwardly to a vertically extending

position from which distal edges thereof may then be bent inwardly and downwardly under the influence of the vibratable floatable screed plate member 220.

The finishing edger rail elements 214 and 216 are attached to the table by connector elements 236, 237, 238 and 239 such
5 that the lower edge of each of the finishing edger rail elements is spaced apart from the table 50 so as to define a nip sufficient to allow the conveyor belt to pass there. The rail elements are also spaced apart a desired predetermined
10 distance so as to assure that the inner surface thereof may sliding abut respective panel side edges. If desired the finishing edger rail elements 214 and 216 may be fixed in place by the above mentioned connector elements. However, if desired the edger rail elements may be laterally adjustable in
15 order to accommodate panels of different width. For example the connector elements may have an outer shell and an inner telescoping member and an adjustment bolt; these elements by way of illustration are designated with respect to connector 237 respectively by numbers 250 251 and 252. The bolt may be
20 suitably attache in any manner to the back of the outer shell so that rotation of the bolt in one direction will induce the edger rail element 214 to move laterally inward while a

reverse rotation will induce a laterally outward displacement of the edger rail element 214.

The vibratable floatable screed member 220 comprises an elongated plate 260 and a vibrator 265 (e.g. a compressed air turbine vibrator) for inducing the plate 260 to vibrate up and down. The vibrator is connected to a suitable energisation source (not shown). The plate 260 extends between the inner surfaces of the finishing edger rail elements 214 and 216 and is sufficiently long so as to overlap top marginal regions of the top broad face of the panel being made. The vibratable floatable screed member 220 is made of a relatively light weight material so that it is able to essentially float over the upper top mesh and yet be able to ride over distal parts of the side edge meshes and protective film as the panel passes thereunder, i.e. so as to complete the inward and downward bending of distal edges of the side edge meshes. The plate 260 may for example weigh from 20 to 60 pounds, be 3" to 9" wide, and be of aluminum. The vibratable floatable screed member 220 is maintained in position against the movement of the panel there underneath by bumper or stop elements 270 and 271 which may have rubberised tips 272 and 273. The vibrator 265 may vibrate the plate 260 so as to

induce the upper mesh as well as the bent over edge mesh portions overlapping the upper mesh to become embedded in surface of the core mix layer.

As mentioned the Protective film and the bands are turned
5 upside-down (folded) along the board's edges; the folded over webs are designated by the reference number 221.

Advantageously, sufficient distance (for example 10 to 20
feet) is provided between the screed roller and the vibrating
bars such that the band may be folded naturally, releasing the
10 tension that can cause the band to spring out of the board's surface. The finishing edger rail elements may start for example from 20 to 5 feet before the vibrating plate. These edger rail elements 214 and 216 help the protective film and the bands to be folded without ripples or uneven tension and
15 inhibit the changing of the board dimensions when subject to the aforementioned under vibrations.

The apparatus has a pair of edge compression ski components
222 and 224 for smoothing out the edge regions and providing
20 the edges with an outward taper (please see figures 15, 16 and 17). The edge compression ski components 222 and 224 each comprise a ski shaped engagement element 275 or 276 for riding

an edge of the panel. The ski shaped engagement elements 275 and 276 are fastened to a support bar 280 by respective brackets 281 or 282. The support bar 280 itself is suspended above and fixed to the table 54 on opposite sides of the conveyor belt 50 by upright support elements 285 and 286.

5

The ski shaped engagement elements 275 and 276 are each attached to respective brackets by a pair of nut/shaft systems. The following will describe one such nut/shaft system in relation to the component 222; the other nut/shaft systems are the same.

10

Referring to component 222 the nut/shaft system comprises a threaded shaft 290 and a pair of nuts; an upper nut being designated by the reference number 291. The threaded shaft 290 is attached at one end to the ski engagement element 275 and the other distal end engages a threaded channel in bracket 281; the distal end of shaft 290 extends through the threaded channel and engages the upper nut 291. The second nut engages the threaded shaft just below the bracket 281. The nuts may be made to releasably clamp the shaft 290 to the bracket 281 by suitable rotation thereof in opposite directions. By displacing the nuts along the shaft the ski engagement element may be made to exert more or less pressure on the adjacent

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panel edge. One of the nut/shaft systems of component 222 may be used to vary the pressure of the ski shaped engagement element on the outboard side of the edge and the other nut/shaft system may be used to vary the pressure on the inboard side of the same edge; in general more pressure is applied to the outboard side of the edge than the inboard side thereof so that an edge has a somewhat outwardly tapered (please see figures 15 to 17). Additionally the ski engagement element 275 is disposed such that the ski like tip thereof is upstream relative to the other end thereof and the longitudinal axis of the ski element is disposed transversely with respect the longitudinal axis of the panel. Although the mechanism for inducing the ski elements to press down on the edges has been described in terms of a nut/shaft system, any other type of biasing means may of course be used, e.g. a spring biased system.

Once past the finishing station the elongated panel product may be sent on the conveyor to any known type of curing station (e.g. a curing oven). After the curing station the panel may then be transferred from the conveyor belt to a cutting station where the panels are cut to size; prior to transferring the panel to the cutting station the protective

film may be separated and recovered. Thereafter the cut panels may be sent to a stacking/packaging station where the panels may be moist cured for 3 to 7 days before shipping. The end drive roller for the conveyor belt may be located between the curing and cutting stations.

5

Referring to figure 21 this figure is the same as figure 18 but it additionally shows an example tape application station for application of an adhesive tape to the core side of the bands 60 and 62 so as to provide a panel in accordance with the present invention wherein the bridging member is not
10 adhered to the core as described above. Since figure 21 is except as noted above the same as figure 18 figure 21 will not include all of the reference numbers of figure 18.

15 The tape application station includes a pair of rolls of tape 300 and 301, a threaded tape support rod 302, a plurality of clamp nuts (each generally designated by the reference number 304), upright support members 306 and 308, tape alignment components 310 and 311, and tape pressure application
20 components 313 and 315.

The rolls of tape include tape cores through which the tape

support rod 302 may be threaded; a tape core is sized such that a roll of tape is freely rotatable about the support rod 302. A roll of tape (300 or 301) is maintained in essentially one predetermined position by being bracketed between adjacent clamp nuts 304. The upright support members 306 and 308 have upper openings through which the threaded rod 302 extends. The rod 302 is similarly maintained in place by clamp nuts 304. The alignment components each include a respective arm 320 and 321 which bring the tape to an initial close proximity to a respective underlying band (60 or 62) such that a subsequent upstream tape pressure application component 313 or 315 may press down on the tape such that the adhesive thereof causes the tape to be adhered to the band. The tape pressure application components 313 and 315 each respectively includes a contact element 320 or 321 hinged at one side to a respective support arm 322 or 323; the contact elements are biased by a respective bias spring 325 or 326 such that the side of the contact element opposite the hinged side thereof is biased so as to slide over the tape urging the tape into adhesive contact with the band (60 or 62). With the tape in place a panel as discussed with respect to figures 13, 13a, 14 and 14a may be manufactured.

Instead of the above described tape mechanism one could use an analogous a paint applicator, wax applicator etc.

Figure 22 shows an example mechanism for feeding reinforcing strips or bands 60 and 62 to the apparatus forward end illustrated in figure 18. As may be seen rolls of mesh bands 330 and 340 are rotatably attached to shafts 345 and 346; the attachment may in any suitable fashion so as to be able to let out the bands as necessary. For example the rolls may have central cores 350 and 351 which may be able to slide over the shafts 345 and 346 in the manner of rotatable sleeves. The rolls may be maintained in place by a block arm releasably screwed to a respective shaft 345 or 346; the block arms inhibiting longitudinal axial movement of the rolls off of the shaft but not rotation movement about the shaft. The mechanism include 45 degree slide arms 360 and 370 for changing the direction of motion of the bands by 90 degrees as well as a base support structure 380 and 381.

Figure 23 illustrates in schematic perspective view an edge strength test for a panel section 400 having an edge reinforcement in accordance with the present invention and a panel section 410 having a known wrap around reinforced edge

such as illustrated in U.S. patent no. 5,221,386 the entire contents of which are incorporated herein by reference (see figure 6 of this patent). Both panels are screwed to spaced wood blocks by screws; screws 411 are shown as being just adjacent to the outer edge of each panel section. As may be
5 seen the prior art panel 410 has edge failure but not the panel 400 of the present invention when applying a screw close to the edge. A panel in accordance with the present invention thus may permit the installation of fasteners close to the edge (0.5" or less) without damaging them and thus
10 provide superior fastener pull resistance.

As may be appreciated from the above, in accordance with the present invention it is in particular for example, possible to manufacture a cement board having impact resistant edges
15 by applying to the edge area of the board a continuous band of synthetic, alkali-resistant, non-woven fabric of sufficient strength and elasticity to completely cover the edge of the board with a U-shaped reinforcing mesh without sacrificing the scoring ability of the latter. In accordance with the present
20 invention it is possible, for example to obtain a cementitious board having smooth longitudinal edges which may be impact resistant by the addition of a U-shaped non-woven

fabric not embedded nor below the longitudinal minor edge face, i.e. the reinforcing mesh in the region of the minor surface may abut or be alternatively cemented thereto.

As an example of a non-woven non-oriented mesh which may be used herein may be SYNFAB described as a polypropylene, staple fiber, needle punched, nonwoven fabric having the following characteristics:

Mass per unit a:	2.5 oz per sq yd
tensile strength at bk:	70 pounds
tensile strength at 15 percent elongation:	15 pounds
Elongation at bk:	60 percent
Elongation at 15 lb tensile strength:	15 percent
Trap tear strength:	25 pounds
Mullen burst strength:	175psi

The following tables give example compositions for the slurry and core mix as well as certain characteristic of a panel made in accordance with the present invention.

SLURRY FORMULATION

Slurry	Generic Formula	Preferred Specific formula
	Percentage in weight	Percentage in weight
Portland cement	Type 1 Portland cement 50-80% Type 2 Portland cement 50-80% Type 3 Portland cement 50-80% Type 4 Portland cement 50-80%	Type 1 Portland 81% +/-5%
Fly ash	0-30%	0%
Calcium sulfate	0-10%	0%
Calcium carbonate	0-10%	0%
High alumina cement	Blaine 4000 to 5000: 2-20% Blaine 5000 to 6000: 1-15%	Blaine 4000 to 5000 10+/-5%
Water	5-20%	8% +/-2%
Air entraining agent	0-5%	0%
Plasticizer	0-5%	0.8%+/-0.2%
Total		100 +/-5%

For the core information

Core	Generic Formula	Preferred Specific formula
	Percentage in weight	Percentage in weight
Portland cement	Type 1 Portland cement 30-50% Type 2 Portland cement 30-50% Type 3 Portland cement 30-50% Type 4 Portland cement 30-50%	Type 1 Portland cement 34 +/-2%

High alumina cement	Blaine 4000 to 5000: 2-20% Blaine 5000 to 6000: 1-15%	Blaine 4000 to 5000 4% +/-2%
aggregate	Mortar sand 0-1/16" 30 to 60% Concrete sand 0-1/8 30 to 60% Expanded Clay 15 to 50% Expanded schist 15 to 50% Expanded slag 15 to 50% Expanded vermiculite 2-10% Expanded perlite 2-10%	mortar sand 48% +/-2%
Polystyrene	flame retardant 0-1/8" dia	1% +/-0.2%
Water	drinkable 10-30%	drinkable 11 +/-5%
Air entraining agent	Generic surfactant 0-2% Deceth sulfate 0-2% Laureth sulfate 0-2%	Generic surfactant 0.015%+/- 0.005%
Total		100% +/-5%
Slurry		
Portland cement	Ciment St-Laurent Lafarge Ciment Quebec	81% +/-5%
Accelerator	Lafarge Calcium Aluminate Lehigh Cement	10 +/-5%
Water	N/A	8% +/-2%
Plasticizer	Euclid Master-Builders Grace	0.8% +/-0.2%

Total		100 +/-5%
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Board Characteristics

5	Physical test	Preferred value	Generic value
	Unit weight	2.7 lbs /sq.ft	2.5 to 3.3 lb/sq. ft
	Water absorption	8.6%	5 to 30%
	Humidified deflection	0"	0 to 0.01
	Linear variation	0.049%	0 to 0.10
10	Flexural strength	1100 psi	200 to 2000 psi
	Nail pull resistance (wet)	121 lbf	50 to 200 lbf
	Nail pull resistance (dry)	164 lbf	50 to 200 lbf
	Compressive strength	971 psi	750 to 4000 psi
	Joint depth	0.14"	0 to 0.2"
15	Squaring	0 mm	0 to 0.2"
	Freeze/thaw resistance as % of loss	0.32%	0.32%
	Fire resistance	1hr, 2hrs	45 minutes, 1hr, 2hrs, 3hrs
	Flame spd	0	0 -10
20	Smoke density	0	0 -10
	Wind Load (1/2"x4x8, studs 16" o.c.)	75 psf	30 to 100 psf
	Bond strength of mortar	58 psi	25 to 300 psi
	Sound transmission Class	56* Stc	45 to 65 stc
25	Indentation resistance	256 lbf	200 to 500 lbf
	Bending radius	5'	0.5 to 8 feet

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Falling ball impact	8.8"	5 to 16"
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I claim

1. A cementitious panel comprising a longitudinal side edge face, a pair of opposed broad faces, a longitudinal marginal edge, a light weight cementitious core, a first broad face
5 reinforcing mesh component, a second broad face reinforcing mesh component, and a first edge reinforcing mesh component, each broad face comprising a marginal a bordering said longitudinal edge face
said longitudinal marginal edge comprising a marginal a
10 of one of said broad faces, an opposed marginal a of the other of said broad faces and said longitudinal side edge face,
said first and second broad face reinforcing mesh components each being adhered to said core at a respective broad face,
15 said first edge reinforcing mesh component comprising an edge strip member being adhered to said core at a marginal a of said longitudinal marginal edge,
said first and second broad face reinforcing meshes and said first edge reinforcing mesh being configured and disposed
20 such that said strip member overlaps one of said first and second reinforcing meshes in a respective marginal a of

said longitudinal marginal edge.

2. A cementitious panel as defined in claim 1 wherein the reinforcing mesh overlapped by said strip member is offset inwardly relative to the longitudinal side edge face of said longitudinal marginal edge.

3. A cementitious panel comprising a longitudinal side edge face, a pair of opposed broad faces, a longitudinal marginal edge, a light weight cementitious core, a first broad face reinforcing mesh component, a second broad face reinforcing mesh component, and a first edge reinforcing mesh component, each broad face comprising a marginal a bordering said longitudinal edge face

said longitudinal marginal edge comprising a marginal a of one of said broad faces, an opposed marginal a of the other of said broad faces and said longitudinal side edge face,

said first and second broad face reinforcing mesh components each being adhered to said core at a respective broad face,

said first edge reinforcing mesh component comprising first and second edge strip members being adhered to said core

at respective opposed marginal as of said longitudinal marginal edge,

said first and second broad face reinforcing meshes and said first edge reinforcing mesh being configured and disposed such that said first and second strip members respectively
5 overlap the first and second reinforcing meshes in the marginal as of said longitudinal marginal edge.

4. A cementitious panel as defined in claim 3 wherein said first and second broad face reinforcing meshes are offset
10 inwardly relative to the longitudinal side edge face of said longitudinal marginal edge.

5. A cementitious panel comprising a longitudinal side edge face, a pair of opposed broad faces, a longitudinal marginal
15 edge, a light weight cementitious core, a first broad face reinforcing mesh component, a second broad face reinforcing mesh component, and a first U-shaped edge reinforcing mesh component,

each broad face comprising a marginal a bordering said
20 longitudinal edge face

said longitudinal marginal edge comprising a marginal a of one of said broad faces, an opposed marginal a of

the other of said broad faces and said longitudinal side edge face,

said first and second broad face reinforcing mesh components each being adhered to said core at a respective broad face,

5 said first U-shaped edge reinforcing mesh component comprising first and second edge strip members and a bridging member connecting said first and second edge strip members, said first and second edge strip members being adhered to said core at respective opposed marginal as of said longitudinal
10 marginal edge,
 said first and second broad face reinforcing meshes and said first U-shaped edge reinforcing mesh being configured and disposed such that said first and second strip members respectively overlap the first and second reinforcing meshes
15 in the marginal as of said longitudinal marginal edge.

6. A cementitious panel as defined in claim 5 wherein said first and second broad face reinforcing meshes are offset inwardly relative to the longitudinal side edge face of said
20 longitudinal marginal edge.

7. A cementitious panel as defined in claim 5 wherein said

bridge member is non-adhered to said core at said longitudinal side edge face.

8. A cementitious panel as defined in claim 5 wherein said first and second broad face reinforcing meshes are offset inwardly relative to the longitudinal side edge face of said longitudinal marginal edge and wherein said bridge member is non-adhered to said core at said longitudinal side edge face.

9. A cementitious panel as defined in claim 8 wherein said marginal as comprise an adhesion region and a non-adhesion region, said non-adhesion regions bordering said longitudinal side edge faces and wherein said first and second edge strip members are non-adhered to said core at respective non-adhesion regions.

10. A cementitious panel comprising a pair of opposed longitudinal side edge faces, a pair of opposed broad faces, a pair of opposed longitudinal marginal edges, a light weight cementitious core, a first broad face reinforcing mesh component, a second broad face reinforcing mesh component, a first U-shaped edge reinforcing mesh component and a second U-shaped edge reinforcing mesh component,

each broad face comprising a marginal a bordering each longitudinal edge face

each longitudinal marginal edge comprising a marginal a of one of said broad faces, an opposed marginal a of the other of said broad faces and a respective longitudinal side edge face,

said first and second broad face reinforcing mesh components each being adhered to said core at a respective broad face,

said first and second U-shaped edge reinforcing mesh components each comprising first and second edge strip members and a bridging member connecting said first and second edge strip members, said first and second edge strip members being adhered to said core at respective opposed marginal as of a respective longitudinal marginal edge,

said first and second broad face reinforcing mesh components and said first and second U-shaped edge reinforcing mesh components being configured and disposed such that said first and second strip members respectively overlap the first and second reinforcing meshes in the marginal as of a respective longitudinal marginal edge.

11. A cementitious panel as defined in claim 10 wherein said

first and second broad face reinforcing meshes are offset inwardly relative to the longitudinal side edge faces of said longitudinal marginal edges.

12. A cementitious panel as defined in claim 10 wherein said
5 bridge members are non-adhered to said core at respective longitudinal side edge faces.

13. A cementitious panel as defined in claim 10 wherein said
10 first and second broad face reinforcing meshes are offset inwardly relative to the longitudinal side edge faces of said longitudinal marginal edges and wherein said bridge members are non-adhered to said core at respective longitudinal side edge faces.

14. A cementitious panel as defined in claim 14 wherein said
15 marginal as comprise an adhesion region and a non-adhesion region, said non-adhesion regions bordering said longitudinal side edge faces and wherein said first and second edge strip members are non-adhered to said core at respective non-
20 adhesion regions.

15. A cementitious panel as defined in claim 10 wherein said

first and second broad face reinforcing mesh components are each embedded in a respective broad face of said core and wherein said first and second edge strip members are cemented to said core at respective opposed marginal as of a respective longitudinal marginal edge.

5

16. A cementitious panel as defined in claim 15 wherein said first and second broad face reinforcing meshes are offset inwardly relative to the longitudinal side edge faces of said longitudinal marginal edges and wherein said bridge members are non-adhered to said core at respective longitudinal side edge faces.

10

17. A cementitious panel as defined in claim 15 wherein said bridge members are non-adhered to said core at respective longitudinal side edge faces.

15

18. A cementitious panel as defined in claim 15 wherein said first and second broad face reinforcing meshes are offset inwardly relative to the longitudinal side edge faces of said longitudinal marginal edges and wherein said bridge members are non-adhered to said core at respective longitudinal side edge faces and wherein said bridge members are non-adhered to

20

said core at respective longitudinal side edge faces.

19. A cementitious panel as defined in claim 18 wherein said marginal as comprise an adhesion region and a non-adhesion region, said non-adhesion regions bordering said longitudinal side edge faces and wherein said first and second edge strip members are non-adhered to said core at respective non-adhesion region.

20. A cementitious panel as defined in claim 1 wherein the cementitious core has an average unit weight of not more than about 120 pounds per cubic foot

21. A cementitious panel as defined in claim 5 wherein the first and second broad face mesh components are of a non-woven oriented mesh and the U-shaped edge reinforcing mesh component is of a non-woven non-oriented reinforcing mesh.

22. A cementitious panel as defined in claim 10 wherein the first and second broad face mesh components are of a non-woven oriented mesh and the U-shaped edge reinforcing mesh components are each of a non-woven non-oriented reinforcing mesh.

23. A cementitious panel as defined in claim 15 wherein the first and second broad face mesh components are of a non-woven oriented mesh and the U-shaped edge reinforcing mesh components are each of a non-woven non-oriented reinforcing mesh.

24. A method for manufacturing a reinforced cementitious panel having a reinforced longitudinal edge comprising:
forming a first slurry comprising a cementitious material and water ;

10 forming a core mix comprising a cementitious material, lightweight aggregate and water

providing a panel forming support substrate;

laying over said panel forming support substrate a band of reinforcing mesh;

15 laying a first sheet of reinforcing mesh over said panel forming support substrate such that said sheet of reinforcing mesh overlaps said band at an outer marginal portion of said first sheet of reinforcing mesh,

depositing said first slurry on said first sheet of
20 reinforcing mesh and distributing it across the bdth of said first sheet of reinforcing mesh so as to form a slurried reinforcement layer of predetermined thickness such that the

first sheet of reinforcing mesh is embedded in said slurried reinforcement layer;

depositing said core mix on said slurried reinforcement layer and distributing the core mix across said first sheet of reinforcing mesh so as to form a core layer of predetermined
5 depth having an upper broad surface

laying a second sheet of reinforcing mesh over said core layer such that said second sheet of reinforcing mesh is embedded in said upper broad surface and overlies said first sheet of reinforcing mesh.

10

25. A method for manufacturing a reinforced cementitious panel having a reinforced longitudinal edge comprising:

forming a first slurry comprising a cementitious material and water ;

15 forming a core mix comprising a cementitious material, lightweight aggregate and water

providing a panel forming support substrate;

laying a first sheet of reinforcing mesh over said panel forming support substrate,

20 depositing said first slurry on said first sheet of reinforcing mesh and distributing it across the bdth of said first sheet of reinforcing mesh so as to form a slurried

reinforcement layer of predetermined thickness such that the first sheet of reinforcing mesh is embedded in said slurried reinforcement layer;

depositing said core mix on said slurried reinforcement layer and distributing the core mix across said first sheet of reinforcing mesh so as to form a core layer of predetermined depth having an upper broad surface

laying a second long sheet of reinforcing mesh over said core layer such that said second sheet of reinforcing mesh is embedded in said upper broad surface and overlies said first sheet of reinforcing mesh

laying over said upper broad surface a band of reinforcing mesh such that said band overlaps said second sheet of reinforcing mesh band at an outer marginal portion of said panel and first sheet of reinforcing mesh and is embedded in said upper broad surface.

26. A method for manufacturing a reinforced cementitious panel having a reinforced longitudinal edge comprising:

forming a first slurry comprising a cementitious material and water ;

forming a core mix comprising a cementitious material, lightweight aggregate and water

providing a panel forming support substrate, said panel forming support substrate being wider than the panel to be made;

laying over said panel forming support substrate a band of reinforcing mesh;

5 laying a first sheet of reinforcing mesh over said panel forming support substrate such that said first sheet of reinforcing mesh overlaps a predetermined portion of said first band so as to leave an outer portion of said band uncovered by said first sheet of reinforcing mesh,

10 depositing said first slurry on said first sheet of reinforcing mesh and distributing it across the bdth of said first sheet of reinforcing mesh so as to form a slurried reinforcement layer of predetermined thickness such that the first sheet of reinforcing mesh is embedded in said slurried
15 reinforcement layer;

 depositing said core mix on said slurried reinforcement layer and distributing the core mix across said first sheet of reinforcing mesh so as to form a core layer of predetermined depth having an upper broad surface

20 laying a second indefinitely long sheet of reinforcing mesh over said core layer such that said second sheet of reinforcing mesh is embedded in said upper broad surface and

overlies said first sheet of reinforcing mesh,
bending the outer marginal portions of said band upwardly
to an upright position,
folding upright portions of said band inwardly so as to
overlap said second sheet of reinforcing mesh and such that
5 said band defines a U-shaped edge reinforcing mesh.

27. A method as defined in claim 26 for the manufacture of a
panel wherein said U-shaped edge reinforcing mesh comprises
first and second edge strip members and a bridging member
10 connecting said first and second edge strip members, and said
bridge member is non-adhered to said core, wherein said band
has a non-adhesion zone for the formation of said bridge
member.

15 28. A method for manufacturing a reinforced cementitious
panel having reinforced longitudinal edges comprising:
forming a first slurry comprising a cementitious material
and water ;
forming a core mix comprising a cementitious material,
20 lightweight aggregate and water
providing a panel forming support substrate, said panel
forming support substrate being wider than the panel to be

made;

laying over said panel forming support substrate, in spaced apart parallel relation, a first band of reinforcing mesh and second band of reinforcing mesh;

laying a first sheet of reinforcing mesh over said panel
5 forming support substrate such that said first sheet of reinforcing mesh overlaps a predetermined portion of each of said first and second bands so as to leave an outer portion of each band uncovered by said first sheet of reinforcing mesh,

depositing said first slurry on said first sheet of
10 reinforcing mesh and distributing it across the bdth of said first sheet of reinforcing mesh so as to form a slurried reinforcement layer of predetermined thickness such that the first sheet of reinforcing mesh is embedded in said slurried reinforcement layer;

15 depositing said core mix on said slurried reinforcement layer and distributing the core mix across said first sheet of reinforcing mesh so as to form a core layer of predetermined depth having an upper broad surface

laying a second indefinitely long sheet of reinforcing
20 mesh over said core layer such that said second sheet of reinforcing mesh is embedded in said upper broad surface and overlies said first sheet of reinforcing mesh,

bending the outer marginal portions of said first and second bands upwardly to an upright position,

folding upright portions of said first and second bands inwardly so as to overlap said second sheet of reinforcing mesh and such that each of said first and second bands define
5 a U-shaped edge reinforcing mesh.

29. A method for manufacturing a reinforced cementitious panel having reinforced longitudinal edges comprising:

continuously forming a first slurry comprising a
10 cementitious material and water ;

continuously forming a core mix comprising a cementitious material, lightweight aggregate and water

continuously advancing an indefinitely long panel forming support substrate over a support surface, said panel forming
15 support substrate being wider than the panel to be made;

continuously laying over said panel forming support substrate, in spaced apart parallel relation, an indefinitely long first band of reinforcing mesh and an indefinitely long second band of reinforcing mesh;

20 continuously laying a first indefinitely long sheet of reinforcing mesh over said panel forming support substrate such that said first sheet of reinforcing mesh overlaps a

predetermined portion of each of said first and second bands so as to leave an outer portion of each band uncovered by said first sheet of reinforcing mesh,

continuously depositing said first slurry on said first sheet of reinforcing mesh and distributing it across the bdth
5 of said first sheet of reinforcing mesh so as to form a slurried reinforcement layer of predetermined thickness such that the first sheet of reinforcing mesh is embedded in said slurried reinforcement layer;

continuously depositing said core mix on said slurried
10 reinforcement layer and distributing the core mix across said first sheet of reinforcing mesh so as to form a core layer of predetermined depth having an upper broad surface

continuously laying a second indefinitely long sheet of reinforcing mesh over said core layer such that said second
15 sheet of reinforcing mesh is embedded in said upper broad surface so as to leave an outer marginal portion of each of said bands uncovered by said second sheet of reinforcing mesh,

continuously bending the outer marginal portions of said first and second bands upwardly to an upright position,

20 folding upright portions of said first and second bands inwardly so as to overlap said second indefinitely long sheet of reinforcing mesh and such that each of said first and

second bands define a U-shaped edge reinforcing mesh.

30. An apparatus for manufacturing a reinforced cementitious panel having reinforced longitudinal edges comprising

means for forming a first slurry comprising a
5 cementitious material and water ;

means for forming a core mix comprising a cementitious material, lightweight aggregate and water.

means for providing a panel forming support substrate;

means for laying over said panel forming support

10 substrate a band of reinforcing mesh;

means for laying a first sheet of reinforcing mesh over said panel forming support substrate such that said sheet of reinforcing mesh overlaps said band at an outer marginal portion of said first sheet of reinforcing mesh,

15 means for depositing said first slurry on said first sheet of reinforcing mesh and distributing it across the bdth of said first sheet of reinforcing mesh so as to form a slurried reinforcement layer of predetermined thickness such that the first sheet of reinforcing mesh is embedded in said
20 slurried reinforcement layer;

means for depositing said core mix on said slurried reinforcement layer and distributing the core mix across said

first sheet of reinforcing mesh so as to form a core layer of predetermined depth having an upper broad surface

means for laying a second sheet of reinforcing mesh over said core layer such that said second sheet of reinforcing mesh is embedded in said upper broad surface and overlies said
5 first sheet of reinforcing mesh.

31. A method for manufacturing a reinforced cementitious panel having a reinforced longitudinal edge comprising:

means for forming a first slurry comprising a
10 cementitious material and water ;

means for forming a core mix comprising a cementitious material, lightweight aggregate and water

means for providing a panel forming support substrate;

means for laying a first sheet of reinforcing mesh over
15 said panel forming support substrate,

means for depositing said first slurry on said first
sheet of reinforcing mesh and distributing it across the bdth
of said first sheet of reinforcing mesh so as to form a
slurried reinforcement layer of predetermined thickness such
20 that the first sheet of reinforcing mesh is embedded in said
slurried reinforcement layer;

means for depositing said core mix on said slurried

reinforcement layer and distributing the core mix across said first sheet of reinforcing mesh so as to form a core layer of predetermined depth having an upper broad surface

means for laying a second long sheet of reinforcing mesh over said core layer such that said second sheet of reinforcing mesh is embedded in said upper broad surface and
5 overlies said first sheet of reinforcing mesh

means for laying over said upper broad surface a band of reinforcing mesh such that said band overlaps said second sheet of reinforcing mesh band at an outer marginal portion of
10 said panel and first sheet of reinforcing mesh and is embedded in said upper broad surface.

32. An apparatus for manufacturing a reinforced cementitious panel having a reinforced longitudinal edge comprising:

15 means for forming a first slurry comprising a cementitious material and water ;

means for forming a core mix comprising a cementitious material, lightweight aggregate and water

means for providing a panel forming support substrate,
20 said panel forming support substrate being wider than the panel to be made;

means for laying over said panel forming support

substrate a band of reinforcing mesh;

means for laying a first sheet of reinforcing mesh over said panel forming support substrate such that said first sheet of reinforcing mesh overlaps a predetermined portion of said first band so as to leave an outer portion of said band uncovered by said first sheet of reinforcing mesh,

means for depositing said first slurry on said first sheet of reinforcing mesh and distributing it across the bdth of said first sheet of reinforcing mesh so as to form a slurried reinforcement layer of predetermined thickness such that the first sheet of reinforcing mesh is embedded in said slurried reinforcement layer;

means for depositing said core mix on said slurried reinforcement layer and distributing the core mix across said first sheet of reinforcing mesh so as to form a core layer of predetermined depth having an upper broad surface

means for laying a second indefinitely long sheet of reinforcing mesh over said core layer such that said second sheet of reinforcing mesh is embedded in said upper broad surface and overlies said first sheet of reinforcing mesh,

means for bending the outer marginal portions of said band upwardly to an upright position,

means for folding upright portions of said band inwardly

so as to overlap said second sheet of reinforcing mesh and such that said band defines a U-shaped edge reinforcing mesh.

33. An apparatus as defined in claim 32 for the manufacture of a panel wherein said U-shaped edge reinforcing mesh
5 comprises first and second edge strip members and a bridging member connecting said first and second edgestrip members, and said bridge member is non-adhered to said core, wherein apparatus includes means for applying a non adhesion zone to said band for the formation of said bridge member.

10

34. An apparatus for manufacturing a reinforced cementitious panel having reinforced longitudinal edges comprising:

means for forming a first slurry comprising a cementitious material and water ;

15 means for forming a core mix comprising a cementitious material, lightweight aggregate and water

means for providing a panel forming support substrate, said panel forming support substrate being wider than the panel to be made;

20

means for laying over said panel forming support substrate, in spaced apart parallel relation, a first band of reinforcing mesh and second band of reinforcing mesh;

means for laying a first sheet of reinforcing mesh over said panel forming support substrate such that said first sheet of reinforcing mesh overlaps a predetermined portion of each of said first and second bands so as to leave an outer portion of each band uncovered by said first sheet of reinforcing mesh,

means for depositing said first slurry on said first sheet of reinforcing mesh and distributing it across the bdth of said first sheet of reinforcing mesh so as to form a slurried reinforcement layer of predetermined thickness such that the first sheet of reinforcing mesh is embedded in said slurried reinforcement layer;

means for depositing said core mix on said slurried reinforcement layer and distributing the core mix across said first sheet of reinforcing mesh so as to form a core layer of predetermined depth having an upper broad surface

means for laying a second indefinitely long sheet of reinforcing mesh over said core layer such that said second sheet of reinforcing mesh is embedded in said upper broad surface and overlies said first sheet of reinforcing mesh,

means for bending the outer marginal portions of said first and second bands upwardly to an upright position,

means for folding upright portions of said first and

second bands inwardly so as to overlap said second sheet of reinforcing mesh and such that each of said first and second bands define a U-shaped edge reinforcing mesh.

35. An apparatus for manufacturing a reinforced cementitious panel having reinforced longitudinal edges comprising:

means for continuously forming a first slurry comprising a cementitious material and water ;

means for continuously forming a core mix comprising a cementitious material, lightweight aggregate and water

means for continuously advancing an indefinitely long panel forming support substrate over a support surface, said panel forming support substrate being wider than the panel to be made;

means for continuously laying over said panel forming support substrate, in spaced apart parallel relation, an indefinitely long first band of reinforcing mesh and an indefinitely long second band of reinforcing mesh;

means for continuously laying a first indefinitely long sheet of reinforcing mesh over said panel forming support substrate such that said first sheet of reinforcing mesh overlaps a predetermined portion of each of said first and second bands so as to leave an outer portion of each band

uncovered by said first sheet of reinforcing mesh,

means for continuously depositing said first slurry on said first sheet of reinforcing mesh and distributing it across the bdth of said first sheet of reinforcing mesh so as to form a slurried reinforcement layer of predetermined thickness such that the first sheet of reinforcing mesh is embedded in said slurried reinforcement layer;

means for continuously depositing said core mix on said slurried reinforcement layer and distributing the core mix across said first sheet of reinforcing mesh so as to form a core layer of predetermined depth having an upper broad surface

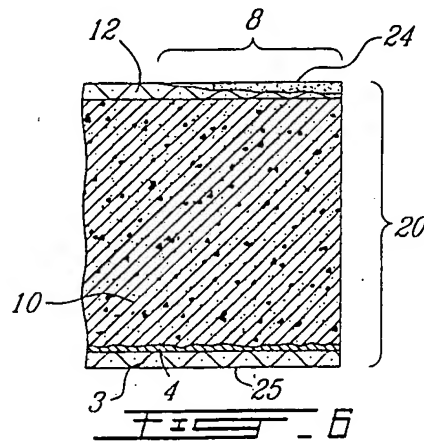
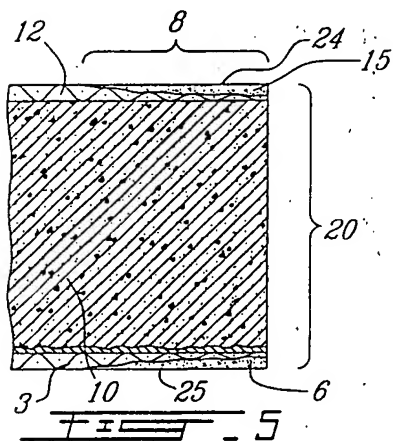
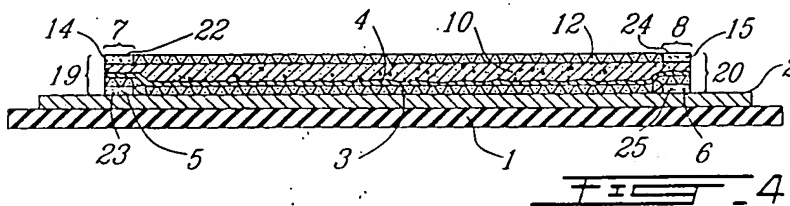
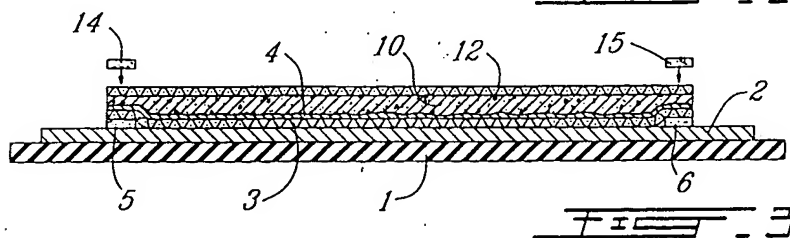
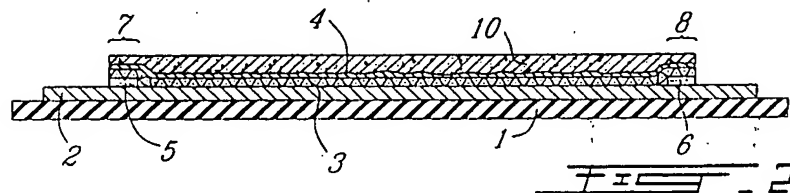
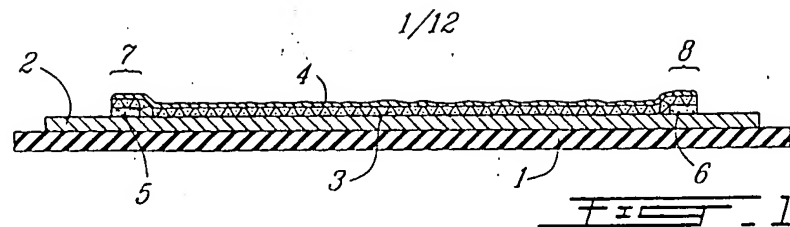
means for continuously laying a second indefinitely long sheet of reinforcing mesh over said core layer such that said second sheet of reinforcing mesh is embedded in said upper broad surface so as to leave an outer marginal portion of each of said bands uncovered by said second sheet of reinforcing mesh,

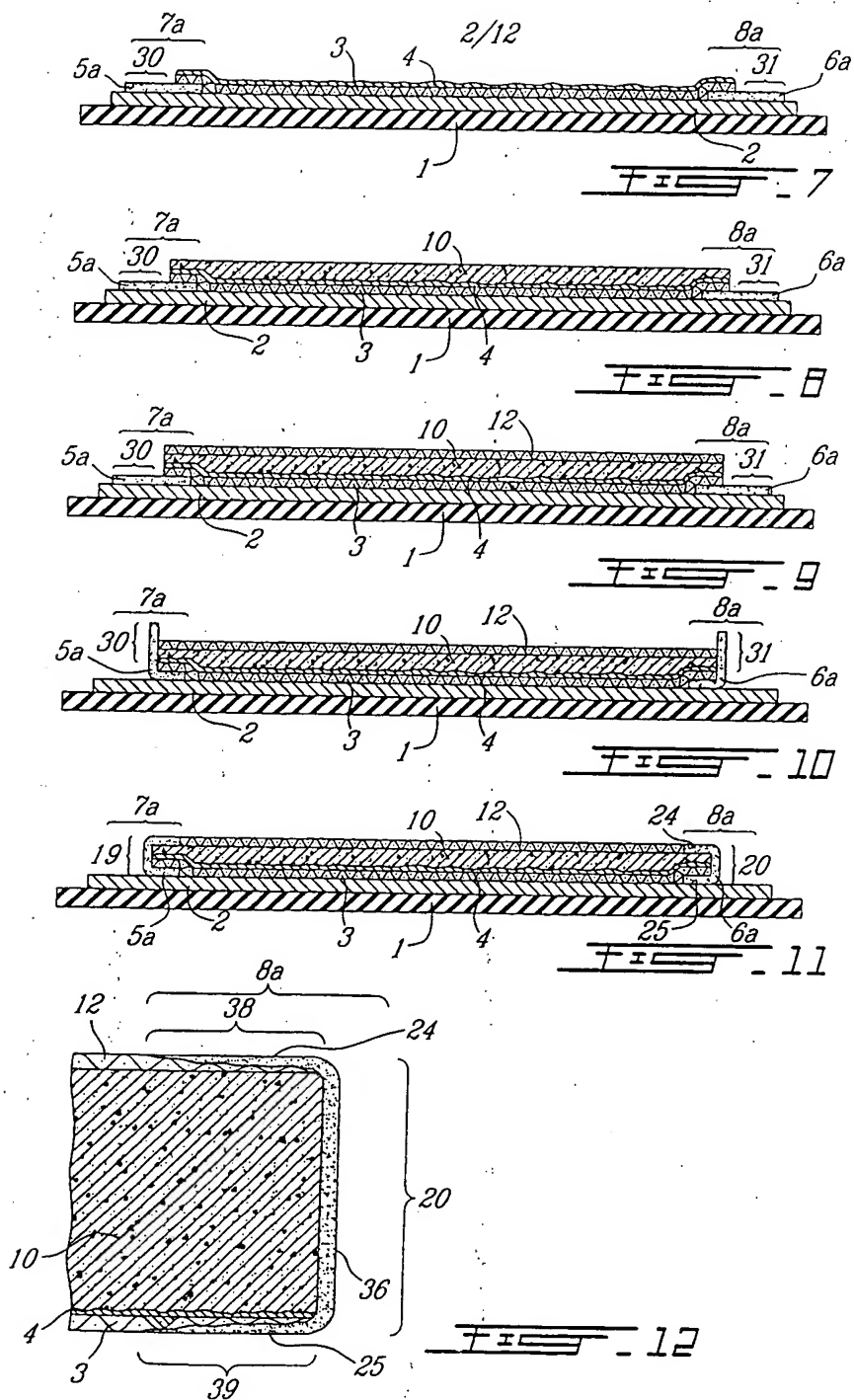
means for continuously bending the outer marginal portions of said first and second bands upwardly to an upright position,

means for folding upright portions of said first and second bands inwardly so as to overlap said second

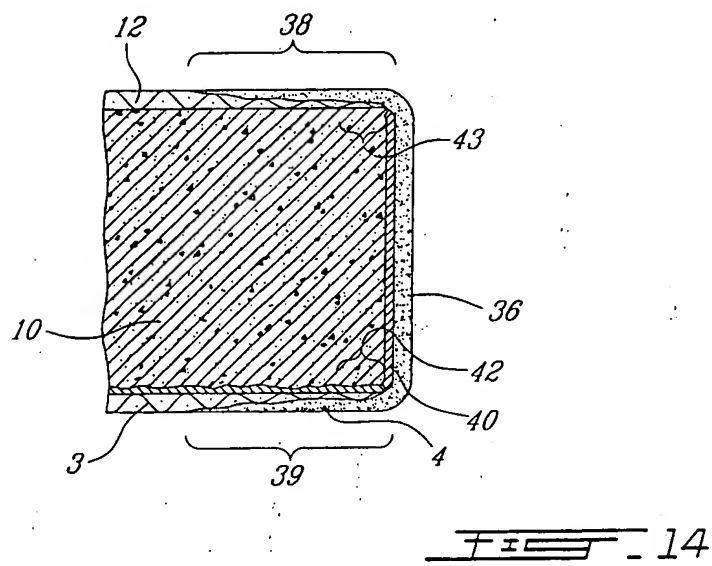
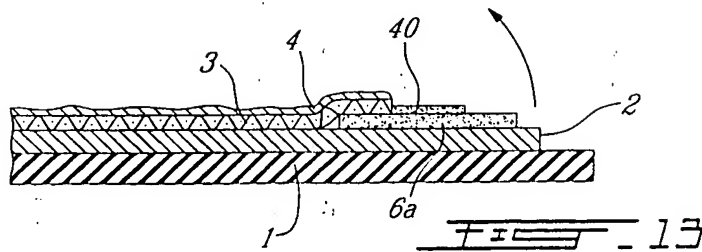
indefinitely long sheet of reinforcing mesh and such that each of said first and second bands define a U-shaped edge reinforcing mesh.

36. A cementitious panel as defined in claim 5 wherein said
5 bridge member is non-embedded in said longitudinal side edge face.

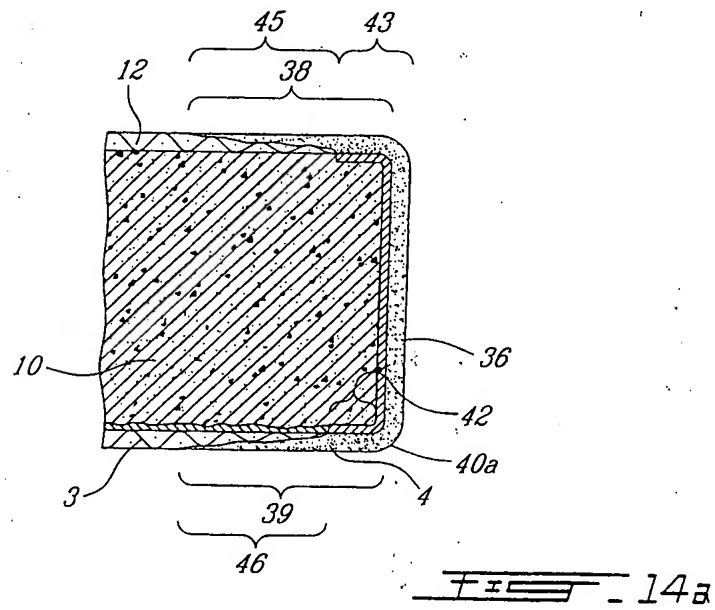
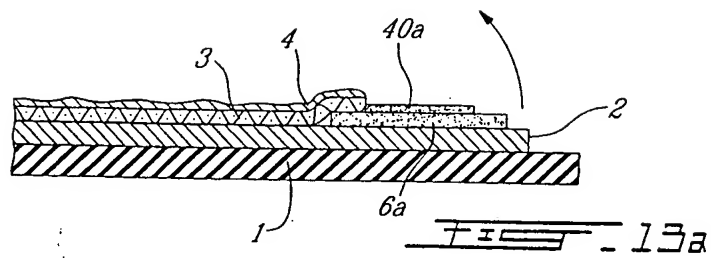




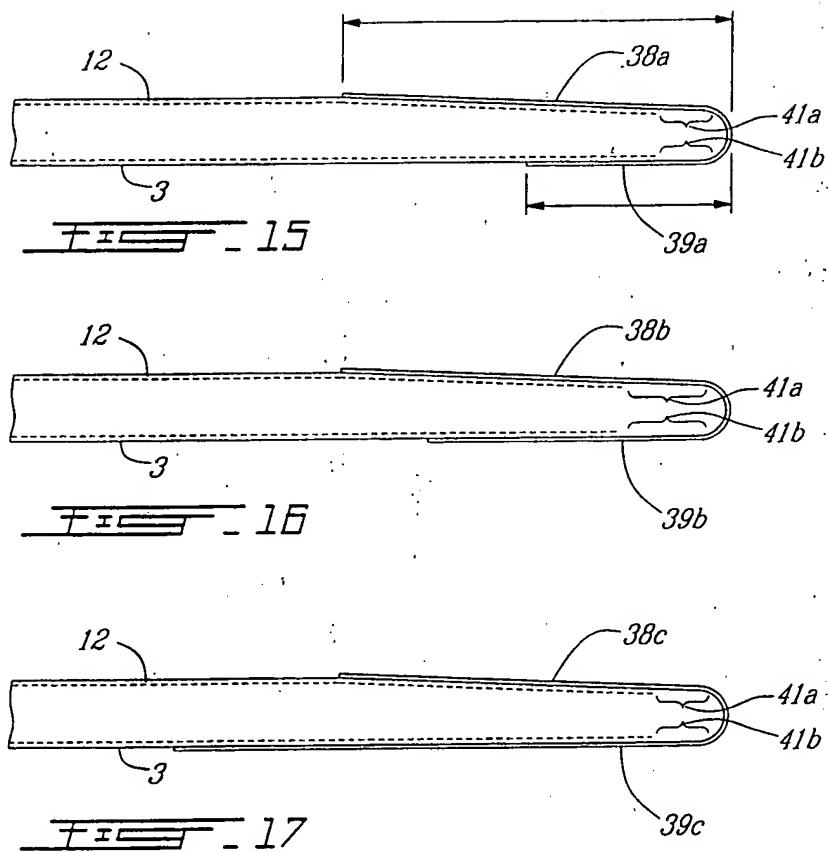
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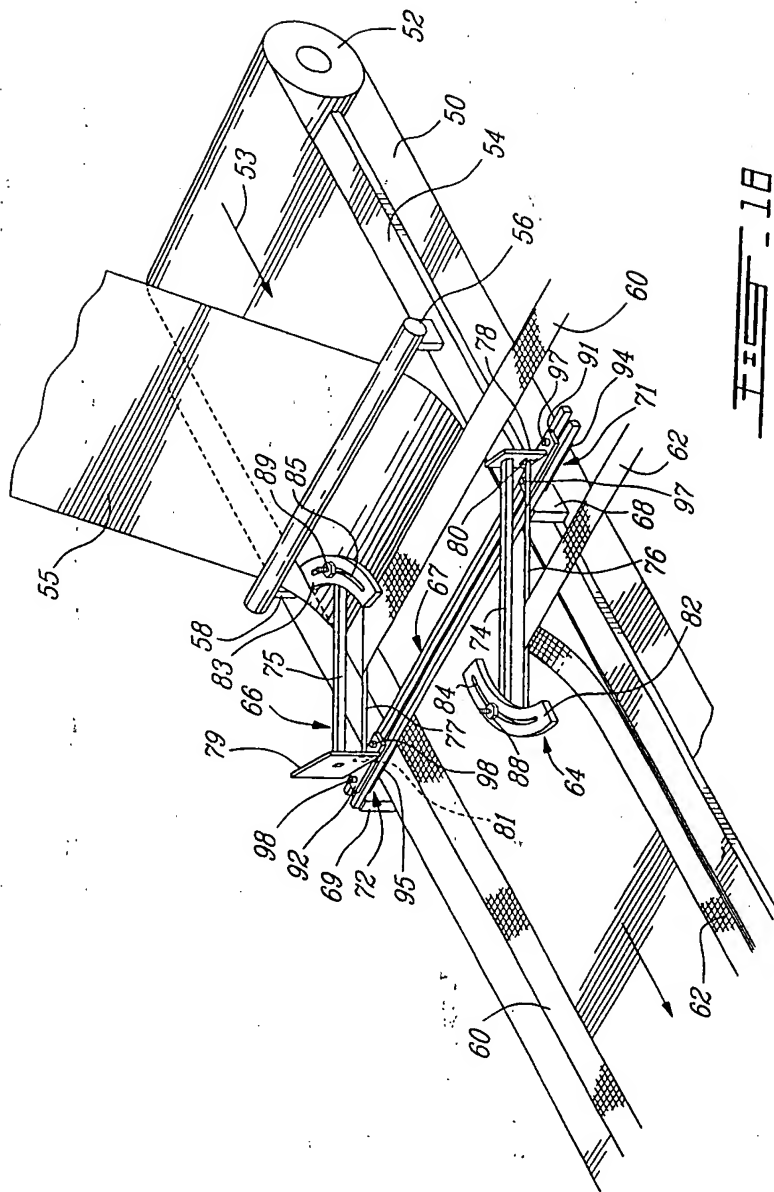
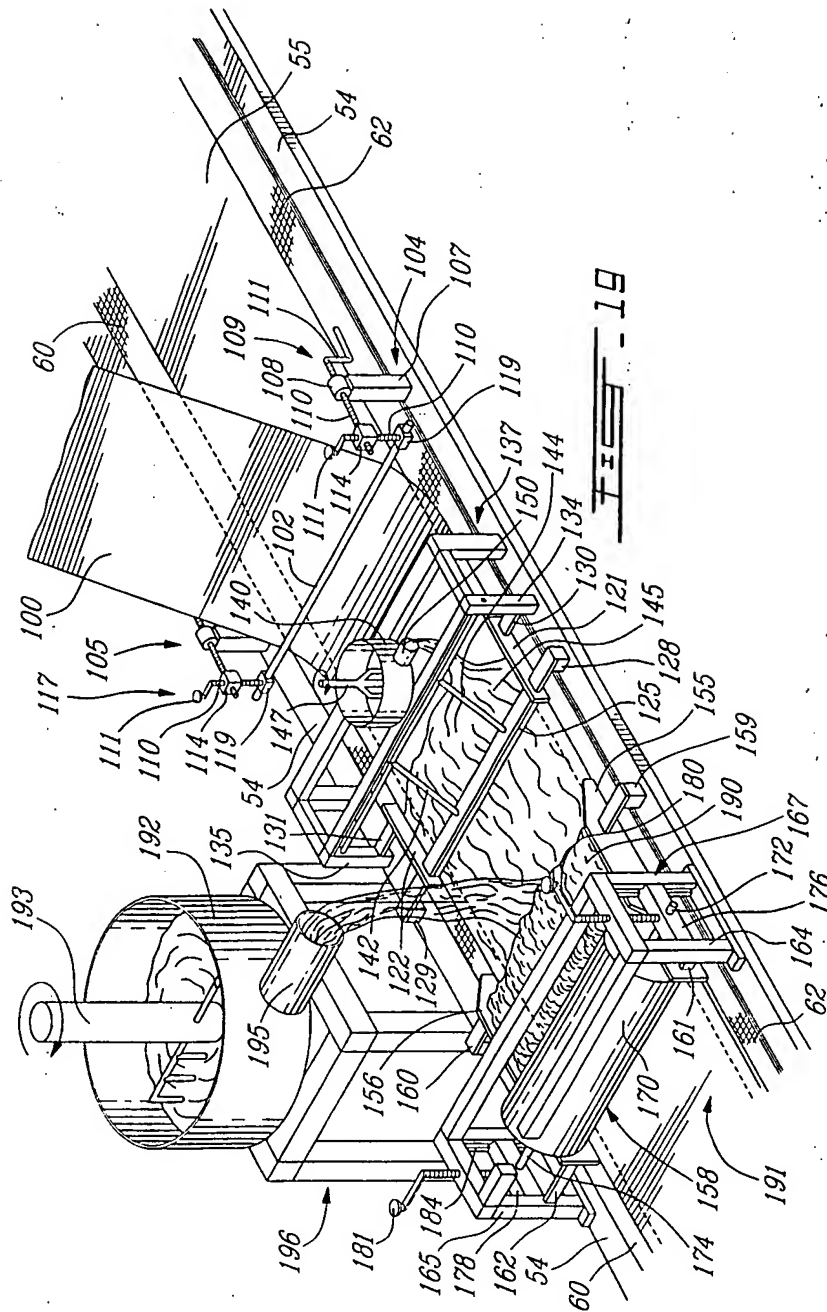
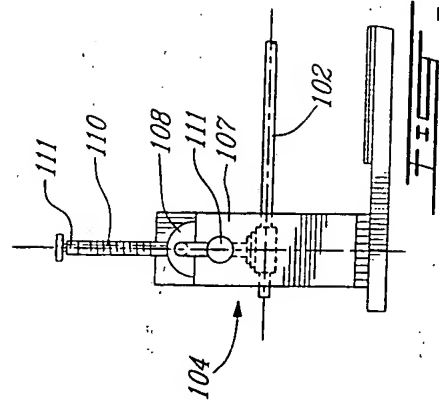
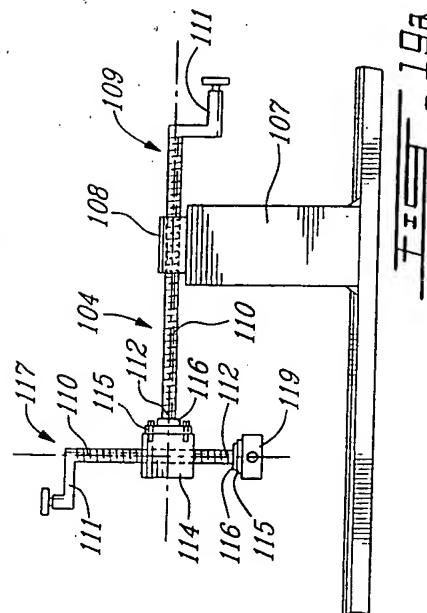
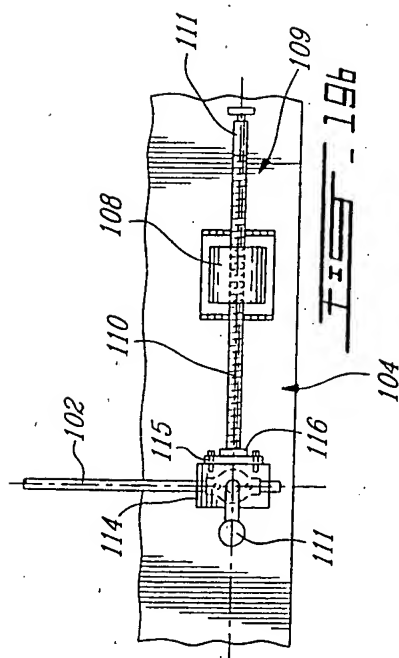


FIG. 1B

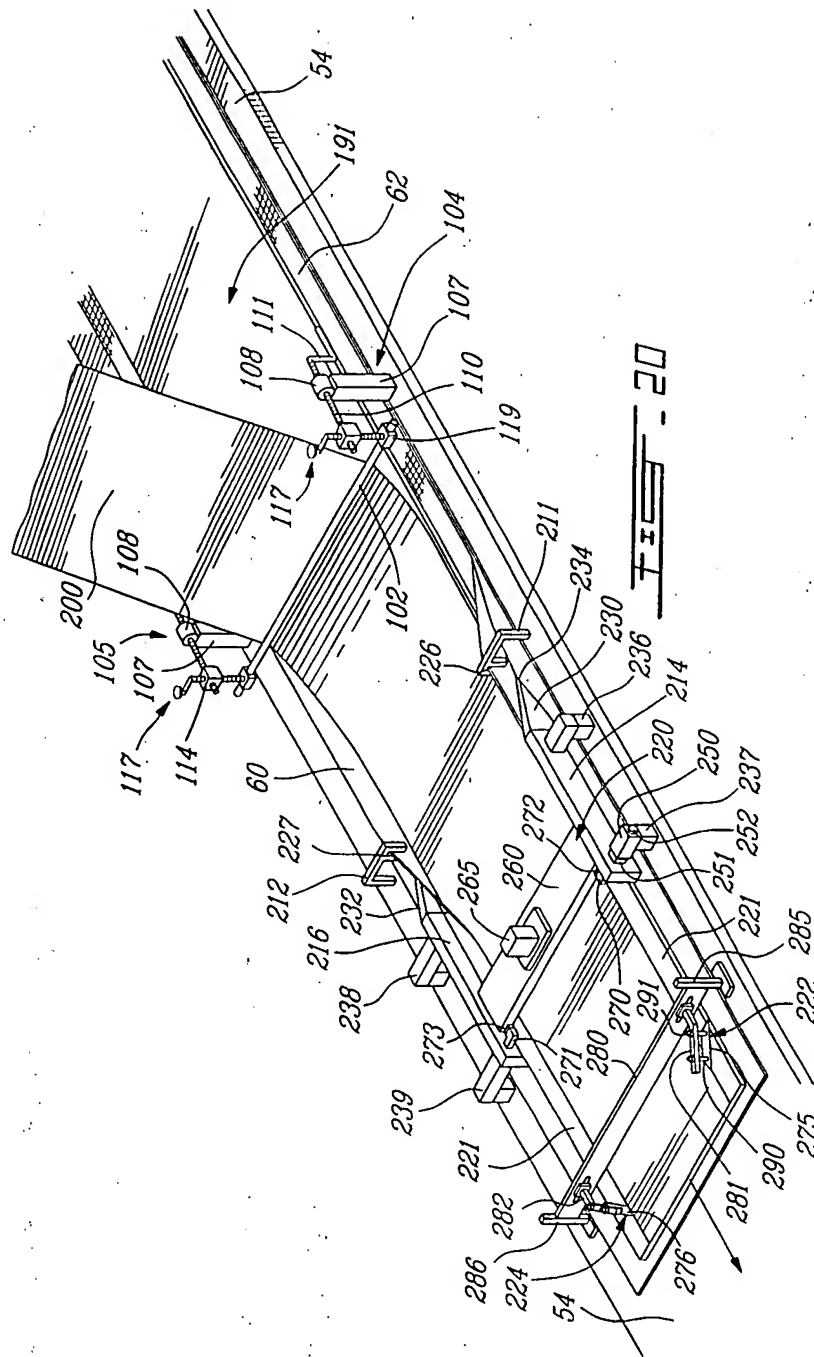
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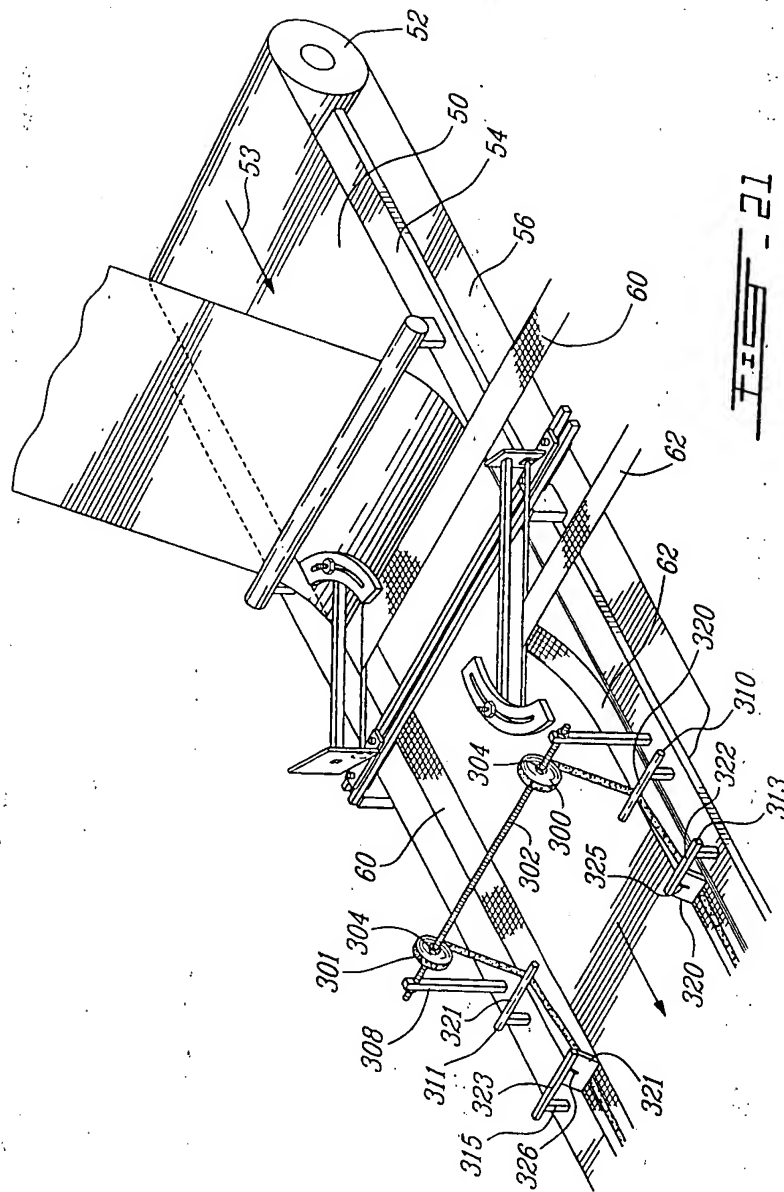


FIG. 21

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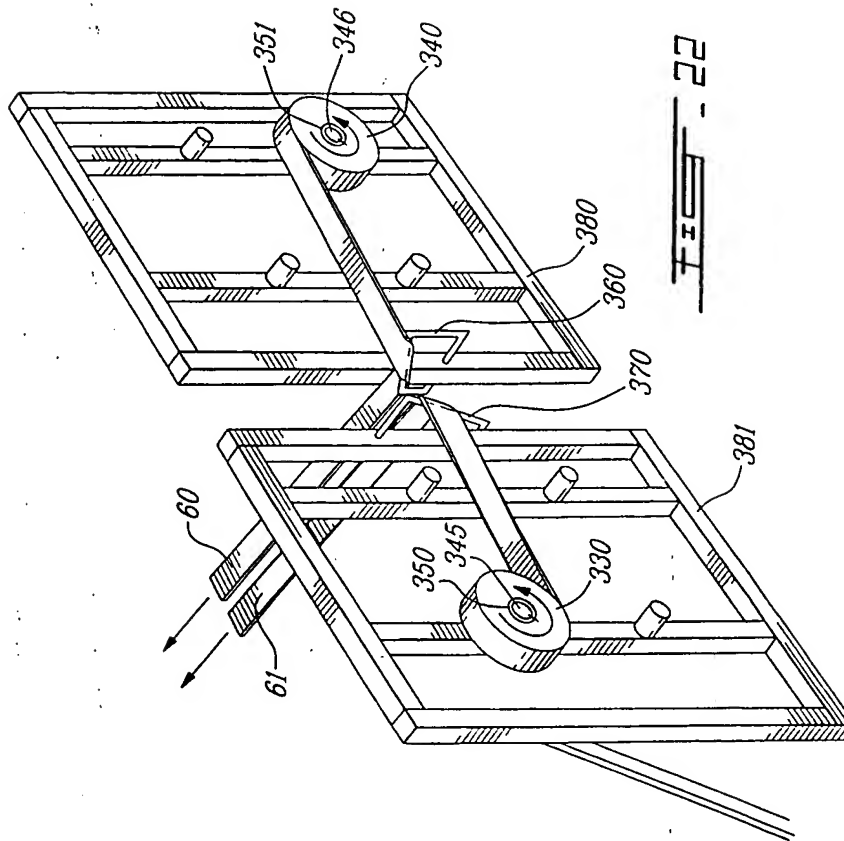


FIG. 22

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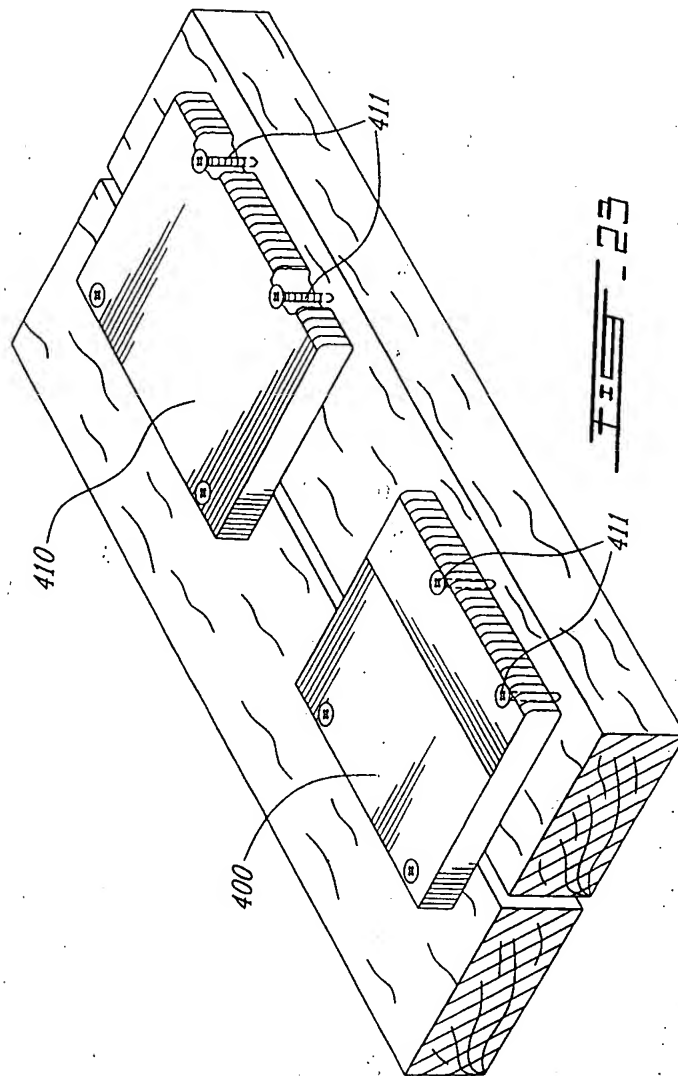


FIG. 23

INTERNATIONAL SEARCH REPORT

Int l Application No
PCT/CA 98/00851A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 E04C/04 B28B19/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 E04C B28B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 1 787 163 A (NEW) 30 December 1930 see the whole document ---	1, 3, 5, 10
A	US 5 221 386 A (ENSMINGER) 22 June 1993 cited in the application see the whole document -----	24-26, 28-32, 34, 35

☐ Further documents are listed in the continuation of box C.☒ Patent family members are listed in annex.

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Date of the actual completion of the international search

17 December 1998

Date of mailing of the international search report

23/12/1998

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SDOCID: <WO_9914449A1_>

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No.

PCT/CA 98/00851

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